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Portfolio Analysis of Delivery and Finance Methods in U.S. Navy Family Housing

by

Marko Medved

B.S. Ocean Engineering
United States Naval Academy, 1989

SUBMITTED TO THE DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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Portfolio Analysis of Delivery and Finance Methods in U.S. Navy Family Housing

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Marko Medved

Submitted to the Department of Civil and Environmental Engineering
on August 05, 2000 in Partial Fulfillment of the Requirements for the Degree of Master of Science in Civil and Environmental Engineering

Abstract

The United States' military housing stock has mirrored the decline of public infrastructure over the past two decades. While direct funding allocations have been cut in half, regulatory instruments that initiated segregated design and construction have remained relatively unchanged. However, recent legislation may assist in redirecting fifty years of momentum in segregated infrastructure procurement. This thesis proposes the use of several project and portfolio tools that demonstrate the advantages of integrated delivery and finance methods. It also depicts several strategic frameworks by which to shape internal organization and procurement structure in order to attract innovative private sector forces.

Two decision support tools were used to analyze Navy housing portfolios at eight installations. First, solicitations, operations and maintenance budget histories, and project programs were collected. This information was assembled in CHOICES© decision support software to analyze portfolio cash flows for varying configurations of delivery and finance methods. Manipulating portfolios at the region and agency level enabled reduction and leveling of cash flow requirements over the entire housing stock's life cycle. Viewing capital programming in this robust context can improve planning for engineers and legislators alike. Next, several construction contract method selection tools were used to illustrate how the same bases could narrow choice of delivery methods based on specific regional, project and market drivers. This process illustrated several plausible delivery types for specific projects in lieu of relying upon pre-determined methods.

Several strategic frameworks were outlined and used to analyze the Naval Facilities and Engineering Command's (NAVFAC) internal structure and its housing procurement and sustainment strategies. First, the case studies were reviewed in light of fundamental principles for public procurement strategy. Results of this assessment call for focus on increasing competition and innovation, maintaining transparency and leveraging private capital. Next, basic frameworks of competitive private sector strategies were used to analyze NAVFAC's organizational and acquisition structures. This process yielded several proposals that would align organization and solicitation configurations to create more attractive infrastructure markets for private industry.

Thesis Supervisor: John B. Miller
Title: Associate Professor of Civil and Environmental Engineering

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Thanks to my parents who instilled in me an eternal quest for knowledge and balance. You have always affirmed what is truly important.

Finally, my deepest admiration and gratitude go out to my loving wife, Maria. You are an amazing mother to Jack and Carly, and you make all dreams worth pursuing possible. Thanks for standing by me.

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LCDR Medved was born and raised in St. Paul, Minnesota. He graduated in 1989 from the United States Naval Academy with a Bachelor of Science degree in Ocean Engineering and was commissioned as an Ensign.

LCDR Medved's first duty assignment was onboard USS LEFTWICH (DD 984), homeported in Peal Harbor, Hawaii where he served as the Damage Control Officer, Missile Officer and Fire Control Officer. He deployed with LEFTWICH to serve in Desert Shield and Desert Storm in 1989-1990 and returned again to the Persian Gulf in 1992-1993. LCDR Medved received a lateral transfer to the Civil Engineer Corps (CEC) upon return from his second deployment in the summer of 1993, and reported to the Civil Engineer Corps Officer School.

LCDR Medved's commenced his first CEC tour with Resident Officer in Charge of Construction, Puerto Rico Area, in January 1994. Here he managed construction contracts in the U. S. Virgin Islands and upon Naval Station Roosevelt Roads. Early in his tour, LCDR Medved was reassigned in a "split tour" to the Public Works Department. His first PWD assignments as Engineering Branch Manager and Director of the Technical Management Division were devoted to planning, engineering, real estate, and design contracts. Next, he was assigned as Customer Service Officer for the Base Operating Contract.

In October of 1997, LCDR Medved joined the "Professionals" of Naval Mobile Construction Battalion Five just in time to deploy back to Puerto Rico. As a Roosevelt Roads "veteran," he first served as the Assistant Operations Officer. Later in the deployment, he led a Detachment for Training to assist in disaster recovery in Sao Miguel, Azores, Portugal. In the summer of 1998, LCDR Medved was assigned as Charlie Company Commander and Air Detachment Commander, positions he held through homeport and the following deployment to Okinawa.

LCDR Medved attended postgraduate school at the Massachusetts Institute of Technology, graduating with a Master of Science degree in Construction Engineering and Management in August 2000. Upon completion of his degree, he reported to the Deputy Chief of Naval Operations (Logistics) staff to serve as an Action Officer for Naval Ordnance Range Planning and Base Realignment and Closure.

LCDR Medved's awards include the Navy Commendation Medal, Navy Achievement Medal, and Combat Action Ribbon. He holds qualifications in Seabee Combat Warfare and Surface Warfare, is a member of the Defense Acquisition Professional Community, and is a registered Professional Engineer in the Commonwealth of Puerto Rico.

LCDR Medved and his wife, Maria, currently reside in Burke, Virginia, with their two children, Jack and Carly.

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1 Introduction

1.1 Infrastructure Development

1.1.1 American Infrastructure

The United States continues to enjoy the fruits of its burgeoning economy as we race into the 21st century. Supporting this amazing productivity and resulting high standard of living is one of the world's most developed infrastructures. Intricate networks of transportation, utilities, information and facility systems continue to grow at an alarming rate. However, while U. S. construction expenditures are growing toward $500 billion / year, the state of American infrastructure decay is also accelerating. (ENR 2000)

American infrastructure has cycled through numerous eras of growth, most of which relied upon joint public and private efforts. However the past fifty years in public infrastructure development have focused on attempting to perfect a single strategy for infrastructure acquisition, redevelopment, and operations. Since World War II, public sector administration has continued to "engineer" an immense web of regulatory requirements tying public agencies to a pre-determined Design Bid Build methods. Accordingly, public agencies and private industry have tailored their strategies to "succeed" in this environment.

This segregated delivery and direct finance approach to designing, constructing, operating, and maintaining infrastructure projects worked well within the context of huge federal grant programs for transportation and water treatment systems prior to 1980. Discretionary funding for programs such as the national defense and infrastructure have continued to decline for the past four decades. For example, funding allocation for infrastructure has dropped significantly from six percent in 1960 to three percent in 1990. (Miller 2000) Strangely, as federal infrastructure funding has gradually been constricted, government agencies at the federal state, and local level have been chartered to "do more with less" without any "new" tools to fulfil rising public expectations. To further complicate matters, agency planning efforts are often directly contingent upon annual, uncontrollable federal appropriations, a system that works against planning efforts and the inherent long-term nature of infrastructure requirements.

The resulting state of public infrastructure appears to be forcing change, slowly. Professor John B. Miller of the Massachusetts Institute Technology frames an Integrated Engineering Systems strategy that can assist agencies in overcoming the effects of fifty years of a "single track" strategy that has severely segregated the Engineering Procurement Construction industry. Miller prescribes returning to a "dual track" strategy whereby the public and private sectors jointly forge new infrastructure and revitalize the existing foundation. This strategy calls for enabling legislation and corresponding public and private

infrastructure strategies to integrate infrastructure life cycle elements of Design, Construction, Operations and Finance. The vehicles for integrating such elements are standardized, yet distinct delivery methods.[1]

Should access to numerous delivery methods be made available, public agencies should strive to strike a balanced portfolio approach to project delivery in which no one means of delivery or finance is pre-determined. In this paradigm public efforts would be best employed in initial project and portfolio configuration that enables private sector firms to perform required services at increasing levels of productivity.

1.1.2 Military Infrastructure

United States military installations and facilities are the foundation for sustaining performance of the world's most advanced armed forces. U.S. military infrastructure has experienced the same type of cyclical investment levels as public infrastructure. Defense allocations have taken the sharpest cuts in the federal budget, dropping significantly from nearly 50% in 1960 to 15% in 2000. (Miller 2000, Executive Branch 2000) Recent draw-downs in military programs leave the Services with the predicament of maintaining an unwieldy infrastructure without the strong planning authority, adequate direct funding levels, or choice of delivery tools.

As the increasingly complex global environment and shrinking military force has led to increased operational tempo, personnel, equipment, and infrastructure are bearing the burden of this demanding pace. The aging infrastructure plays an increasing role in both military readiness and Quality of Life of service members. In fact, in the modern U. S. military, the two are inseparable. The infrastructure must be functionally and technologically sound in order to meet the growing needs of personnel dependent upon its foundation to enable their military performance.

The major Quality of Life issue concerning infrastructure is Family and Bachelor Housing, This thesis focuses only on Family Housing. The Department of Defense (DOD) has approximately 300,000 houses in its inventory of which 180,000 are in serious need of replacement or repair. The Navy owns approximately 50,000 housing units in the continental United States that house a fraction of their 240,000 families. The Navy expends approximately $2.5 billion annually on family housing benefits annually in the United States.[2] Interestingly, a disproportionate amount of this housing budget, $1.1 billion or 44 percent, is applied toward on-base units.

1.2 Military Housing Climate and Processes

The Quality Of Life of military members and their families continues to be major force in attracting and retaining high-quality personnel. Accordingly, the Chairman of the Joint Chiefs of Staff,

---

[1] Standardized delivery methods are described in Chapter 2.

General Henry Shelton, has outlined four major quality of life areas including healthcare, pay and compensation, retirement benefits, and housing.[3] This demonstrates that the need for safe, adequate housing is currently a top priority of the Defense Department.

1.2.1 Housing Benefits

The DOD's stated policy is to rely on its own housing only when the private sector is unable to provide adequate, affordable housing or when personnel must be housed on base to ensure military readiness. The Navy provides housing to sailors and their families in one of two ways. Sailors who reside on base receive housing and utilities without charge. Those who reside off base receive non-taxable financial compensation called Basic Allowance for Housing (BAH).

BAH rates are established in accordance with the actual housing costs where a member is assigned. In other words, members assigned to high cost areas are compensated with higher BAH rates. On average, current BAH rates cover only 80% of housing and utility costs. (Yim 1999) Recent Secretary of Defense initiatives outline closing this gap to 15% in 2001, and gradually reducing it to parity by 2005. The overall DOD cost for such an effort would total $112 billion over the next five years. (Jowers 2000)

1.2.2 State of Repair

The poor condition of military housing reflects years of neglect. About two thirds of the current stock of military housing was constructed between 1950 and 1966 and requires significant revitalization or replacement. The current backlog of deferred maintenance and revitalization for military housing is estimated at over $16 billion and would take over thirty years to accomplish under the current Military Construction programming paradigm. This type of cycle would keep housing stock in a perpetual state of disrepair. Compounding the problem of repair backlog, was the failure of BAH rates to keep pace with inflation, leaving military members with another less than adequate housing option, particularly in areas with tight real estate markets.

1.2.3 Need for a Different Approach

After realizing the effect of housing conditions on the readiness and retention of military personnel, DOD and congressional leaders forged ahead to break with traditional delivery methods. Acknowledging that lobbying for increased revenues or allocations was not a realistic solution, they resolved to leverage private sector expertise and capital as they have throughout U. S. history.

---

[2] Current budget allots $1.4 billion to housing allowances and $1.1 billion in on-base housing. (Tull 1999)
[3] A recent survey cited housing as a major disincentive for retention. (Romano 1999)

Congress approved the Military Housing Privatization Initiative in 1996 to provide several financial and structural acquisition tools to belay the downward spiral of housing decay. After several years of restructuring acquisitions based on these new authorizations, the DOD now plans to raise its housing stock to acceptable standards within ten years. It also promises to deliver the units at a lower cost to taxpayers than if executed through traditional Design Bid Build methods. Although this may address one problem specific to housing, many systems are plagued with the same situation. Infrastructure decay will continue to accelerate as long as special legislation is required to effect alternative delivery and finance methods. Permanent "tool box" is required that will facilitate a balanced approach to sustaining and expanding upon the great resources that have been put in place.

1.3 Research Approach

1.3.1 Objective

The objective of this thesis is to present several public and private sector infrastructure development strategies and apply them toward military housing development to demonstrate more efficient and cost effective ways of delivering and sustaining high quality housing portfolios. Additionally, the use of strategic decision support tools will be applied to model the advantages and disadvantages of various project delivery and finance methods in project and portfolio management.

1.3.2 Method

This thesis first presents several strategic frameworks and decision-making tools to improve upon current pre-determined means of public sector infrastructure development. Next, several case studies regarding development, operations and management of Navy housing portfolios throughout the United States were developed to demonstrate the use of such strategies and tools in upgrading the housing stock to meet new Quality of Life objectives. Finally, the case studies and Naval Facilities Engineering Command (NAVFAC) structure were reviewed in light of the tool and framework applications.

Research began with a case study of the housing program at the New London Submarine Base in Connecticut. In discovering that New London was starting revitalization of a 2500 house portfolio through a single means of delivery and finance, further research was conducted on other bases in Washington, California, Texas, and Puerto Rico where a variety of project delivery methods were being engaged. Data was gathered through personal, phone and electronic interviews with over fifty Naval Facilities Engineering Command personnel at respective Installations, Engineering Field Divisions, and Headquarters. In all, eight bases' project programming and operations and maintenance histories were analyzed using the decision-support tool CHOICES© to demonstrate the effects of alternative delivery configurations at the base and agency portfolio level. Additionally, strategic analysis was conducted for

housing acquisition in these regions using several frameworks established by John B. Miller[4], Michael E. Porter[5], and Christopher M. Gordon[6].

The following paragraphs outline the objectives of the ensuing chapters:

- Chapter 2 lays the foundation for analysis of the case studies through strategic tools and frameworks. First, delivery methods are defined in terms of Miller's Quadrant Framework. Cash flow analysis is then explained as a precursor to a description of the CHOICES© software. Next, Christopher Gordon's tools for selecting individual project delivery methods are illustrated. The remainder of the chapter focuses on public and private infrastructure strategies. Professor Miller outlines ten Fundamental Elements of Infrastructure Strategy. Next Michael E. Porter's trilogy of Competitive Strategy, Competitive Advantage, and Competitive Advantage of Nations are summarized in light of infrastructure development.
- Chapter 3 outlines how the government and the military currently acquire and maintain housing. First, current regulations and choices available to planners are outlined. Next, the federal budget and OMB scoring processes are described. Third, definitions of military funding and current DOD budgets are depicted. Fourth, NAVFAC's structure and approach to housing delivery are explained. The chapter closes with an overview of Public Private Venture initiatives.
- Chapter 4 presents case studies from New London, Connecticut; Roosevelt Roads, Puerto Rico; Corpus Christi, Ingleside, and Kingsville, Texas; Everett, Washington; and Ventura and San Diego, California. Each base's individual approach to acquiring housing, ranging from purely Design Bid Build to Limited Liability Corporations was depicted in CHOICES© software. Several configurations comparing Design Bid Build, Design Build, and Design Build Operate delivery methods were created for each base and aggregate (agency) portfolio. Additionally, specific project delivery method selection criteria were applied in the San Diego case.
- Chapter 5 discusses the case studies and NAVFAC structure in the context of the strategic tools and frameworks portrayed in Chapter 2. Specific recommendations are provided where application of the tools and frameworks showed significant potential for improvement.

1.3.3 Results

A theme of integration among delivery and finance methods pervades the text, focusing on how public and private sector strengths must be relied upon jointly to achieve high and rising momentum in housing or infrastructure delivery and sustainment. The results of applying the tools and frameworks reveal significant advantages in use of multiple delivery methods, taking a portfolio level approach to program management, and leveraging private industry talent and capital where functions are not inherently military or governmental in nature. The strategic frameworks yielded that government policies and solicitations focused on life-cycle attributes and structured to enable private sector competition,

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[4] Dr. John B. Miller is an Associate Professor at MIT where he teaches project packaging and project delivery in MIT's Construction Management program.

[5] Michael E. Porter is the C. Roland Christensen Professor of Business Administration at the Harvard School of Business.

[6] Christopher M. Gordon, P.E., is the Director for Capital Programs and Logan Airport Modernization at the Massachusetts Port Authority and a lecturer at MIT.

integration and innovation are the route to continual infrastructure upgrade. Several recommendations are made that will enable NAVFAC to structure housing and other infrastructure acquisition strategies that make them more attractive to private sector firms while honing military readiness and maintaining public confidence.

2 Project and Portfolio Delivery

Hypotheses:

1) By taking an Integrated approach to portfolio management, the Navy can realize higher quality housing faster and more economically through use of alternative delivery methods that have proved successful throughout history. Providing engineers, planners and decision-makers with access to such delivery methods is the first step to successful infrastructure delivery and sustainability. Through robust opportunity and flexibility, both the Navy, as owner, and competing providers will configure themselves to produce more innovative, effective, financially and technically superior results. [7]
2) By looking at current drivers affecting the owner, project, market and selection process, owners can narrow their focus to a manageable set of viable delivery methods. No one of these may be ideal, however, those that are not feasible can be eliminated. As all infrastructure projects are unique, these dynamic frameworks provide excellent strategic tools to assist in both project and portfolio level decisions. Application of such tools will allow Navy facilities and engineering personnel at the lowest levels to make better management and delivery decisions.
3) Understanding the forces of Competitive Advantage and government functions that further enable an environment in which top firms can thrive is of utter importance in structuring infrastructure delivery strategies in the 21st century. The traditional, insular government approach to acquisition often positions the strong points of public and private entities against each other instead of combining their assets in a synergistic way. Governments can position procurement policy and programs to meet public objectives while creating a stronger, more competitive industry. If the government structures procurements to meet its needs through competitive opportunities that rival private ventures, high performance companies will respond by repositioning themselves. However, their response will only be as strong as the signal of government's commitment to sustained alternative delivery through transparent, competitive procedures. The huge shortfall in infrastructure maintenance and development can be closed by commitment to basic competitive principles.

2.1 Tools for Infrastructure Portfolio Management

The world infrastructure market continues to provide a vast portion of nations' Gross National Products. Estimated at $3 trillion in annual revenues, this almost incomprehensible amount still leaves developed and developing nations' infrastructure in a state of disrepair. This year's construction project

[7] Professor John B. Miller of MIT provides insight to several useful tools that enable Engineering Systems Integration.

revenue in the United States alone is close to $430 billion, up from $250 billion since 1992. More than half of this amount, $244 billion, is dedicated to residential housing. (ENR 1999)

The past decade of growth is indicative of a strong economy. The Armed Forces are feeling the effects in several respects. They are losing valuable membership due to the strength of the economy. Never before have retention and recruiting rates been so dismal. As a result, the Department of Defense is taking a stronger look at Quality of Life issues such as the condition of their decaying housing stock.

Recent legislation and appropriations support a surge in both funding and alternative delivery method approaches aimed at delivering housing cheaper and faster to areas that need it most. However, this trend needs to be more fully developed. Military funding allocations for housing remain proportionately high despite the downturn of the overall defense budget over the past decade. It will be difficult to sustain this pace in pure competition with mission-specific requirements. Consequently, funding of housing is "fenced" or protected from other uses. Even in the current healthy state of the housing budget, the dilapidated state of housing will be difficult to overcome without further developing alternative delivery strategies and use of private financial leverage.

Research at MIT under Professor J. B. Miller's Infrastructure Development Group demonstrates the advantages of a new paradigm, Engineering Systems Integration. This strategy focuses on the power of integrating common life cycle elements within alternative delivery methods and varying degrees of public and private finance. The focus is not on any one specific delivery or finance method, but on how a series of methods can be packaged to deliver more infrastructure requirements faster and with higher quality. The following sections will detail a series of tools by which infrastructure planners can achieve more effective use of restrained capital in the waning funding environment of public infrastructure maintenance, development and redevelopment. The basic tools include understanding the available delivery methods, a simple framework by which to balance portfolios with varying delivery methods, using discounted cash flows as the basis for comparison and evaluation of projects, and a software application that imbues basic principles of procurement strategy founded in discounted cash flows. Use of such tools will allow public and private infrastructure management entities to create a mutually beneficial, competitive atmosphere.

The same tools and principles can be applied to revitalization of a neglected portfolio of military housing. Obviously the Navy and other services cannot overcome their current deficits without reshaping their basic strategies. The key to reshaping strategies lies in understanding the principles of alternative project delivery and finance and how they can be applied in the public sector. As presented in the following sections, the proposed tools and strategies are not "new," but a combination of previously successful methods matched with modern contract and finance means.

2.1.1 Life Cycle Elements

Infrastructure facilities are developed and maintained (or not developed and maintained) through several processes that define their life (or lack thereof). This cycle entails planning, delivery, operations and maintenance, and replacement or decommissioning. Legislation and government agency regulations over the past fifty years have concentrated on segregating these elements into distinct activities. While this approach may serve its purpose in providing a transparent procurement system, its inflexibility neglects needs of existing systems and cannot reasonably respond to growth requirements.

Planning capital systems is the foundation of infrastructure life cycles. New life cycle and project configuration processes will be discussed further under Section 2.1.2. Here lies the key interface between engineers, architects, planners, financiers, lawyers, developers and the political decision-makers. Similar to the degradation of our infrastructure, the relationship between decision-makers and engineers has been tenuous at best. As engineers have driven themselves into deeper and more specific areas of concentration, they have limited their ability to influence planning. As seen below in the Figure 2-1 planning is the most powerful and influential portion of the life cycle. It is evident that the planning, or "configuration", of projects and portfolios has the most impact for the lowest cost in relation to other activities in the life cycle. Engineers need to embrace the political, legal and economic elements prevalent at this stage if infrastructure systems (or housing portfolios) are to regain their place in enabling social, and economic advancement through national Competitive Advantage.

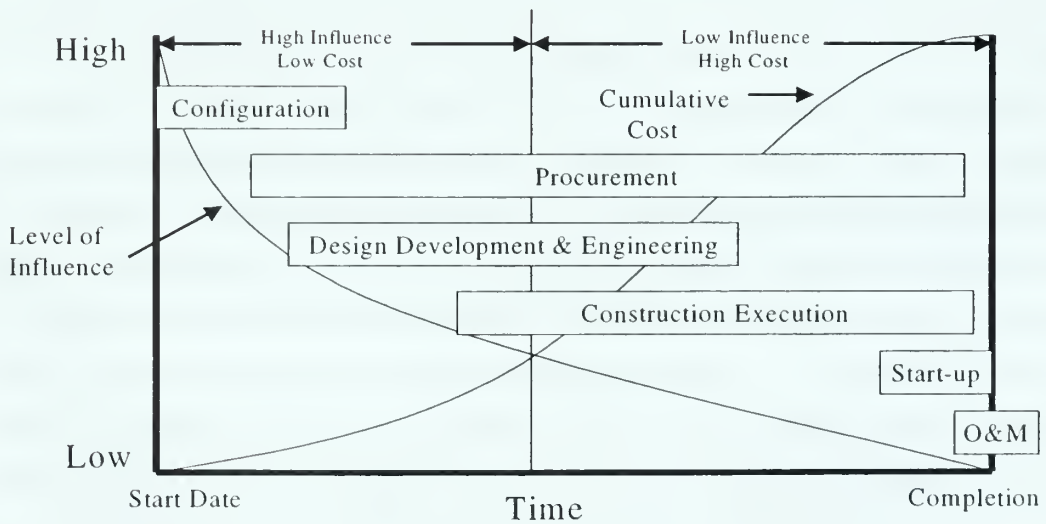

Figure 2-1: Level of Influence and Cumulative Cost throughout Project Development Cycle (Paulson 1976)

Delivery (or procurement as illustrated in Figure 2-1) marks the most visible segment in a project's life cycle. This stage involves design and construction that tend to be focus areas of modern day

engineers. As described previously, public delivery of infrastructure projects has been segmented by law and regulation. The level of integration between the two can radically effect the degree of technical innovation, speed of delivery, constructability, initial costs, and operations and maintenance cost. The choice of technology application is also of growing importance. (Miller 1999b) This is significant from a constructability and an operations and maintenance perspective. As the pace of new technologies continues to quicken, facilities need to be built to accommodate improvements throughout their life cycle. This requires a new degree of collaboration between designers, industry, constructors, and operators as buildings and infrastructure must be more flexible, modular, and ever more sustainable through these changes.

Contrary to many decision-makers' perception, delivery costs generally consist of only 10-15% of a project's life cycle costs. Operations and Maintenance (O & M) spans almost the entire life cycle and consequently requires the greatest portion of funding. Unfortunately, associated O & M cost considerations are often neglected due the segregated nature of public procurement, funding, and facility management. Planners, designers, and builders often have an insular focus that leaves O & M to adjust for their aggregate result. Without adequate foresight and guidance, the resulting requirement for decades of maintenance becomes subject to influences of politically charged planning, inflexibly specified design, and the low-bid construction.

Decisions to replace, revitalize or decommission facilities are the inevitable end or new beginning for existing assets. These way-points may come sooner than projected if 1) design, construction or the O & M program were inadequate, 2) the facility is no longer required, or 3) if the facility is technologically obsolete or financially impracticable. Generally, sub-systems are replaced within the facilities based on individual sub-system life cycles. Sometimes this becomes so extensive that the difference between sub-system and facility replacement blurs. This is the case in many current Navy housing projects where the term "revitalization" is used to describe improvements to housing equal up to 70% of the replacement value. Often the requirement for and use of the facility extend far beyond the natural decision point to upgrade or demolish the facility. Again, this is the case for many public facilities. Deferment of such actions will continue unless a new paradigm in portfolio asset management can be implemented.

Life cycle elements are all dependent upon finance and procurement methods for their development, execution and sustainability. Direct government finance and Design Bid Build delivery are the predominant means by which public facility life cycles are created, sustained, and ended. The next section describes how the combination of the life cycle elements with different finance sources yields a series of viable project delivery methods.

2.1.2 Delivery Method Descriptions

Choice of delivery method and financial source may be the most powerful tools available (or currently unavailable) to improve upon the current infrastructure system. The answer does not lie in more reasonable allocation or in increasing revenue or funding levels. (Miller 2000b) In the public arena, choice of delivery method and funding source is often outside of the planners' control, yet this choice may offer the only hope where significant change is required.

Although there are numerous terms to describe similar methods and many variations of delivery methods, five basic delivery methods are described below. These five methods incorporate differing degrees of life cycle element integration and alternative finance. The five include Design Bid Build, Design Build, Design Build Operate, Design Build Finance Operate, and Operations and Maintenance.

2.1.2.1 Design Bid Build

The first and most prevalent public delivery method is Design Bid Build (DBB). Its use is established by statute for federal procurement and is governed by the Federal Acquisition Regulations. In this method, separate contracts are required for design and construction. Later, a separate contract for O & M is established. Finance is provided directly for all three contracts from government funding. This method was founded in three Federal Acts that established the requirement for direct funding and required separate design contracts.[8] The illustration below represents the long chain involved in delivering and sustaining a project throughout its life cycle using the DBB method.

[8] The Armed Services Procurement Act of 1947, 62 St 21, 2/19/1948 and The Federal Property and Administrative Services Act of 1949, 63 St 377, 6/30/1949 established the requirement for direct, federal funding. The Brooks Architect-Engineers Act, 86 St 1278, 10/27/1972, codified at 40 U.S.C sections 542-544 established the requirement for separate, complete design packages.

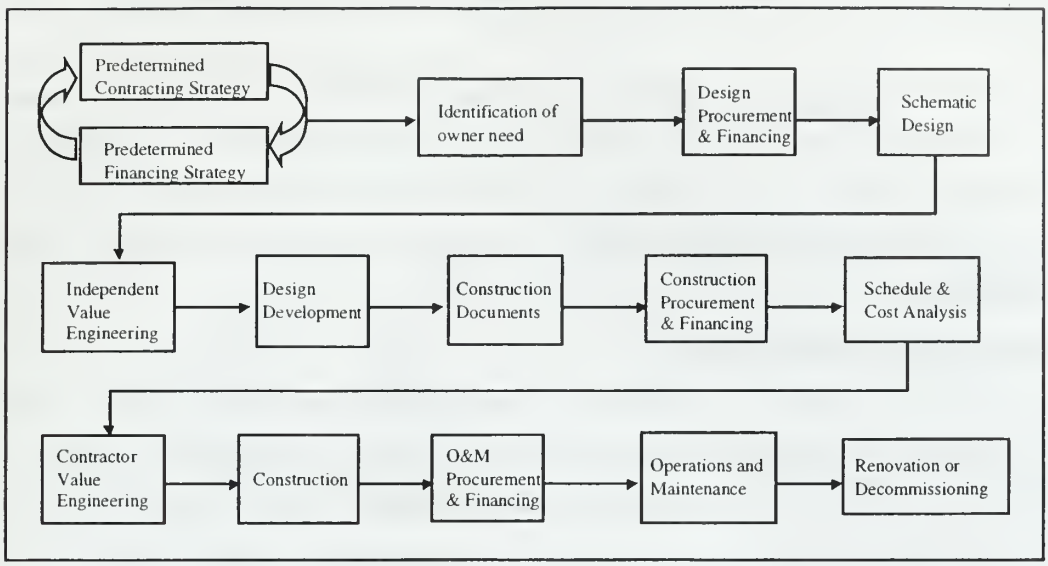

Figure 2-2: Project Life Cycle Supporting the DBB Delivery Method (Mahoney 1998)

2.1.2.2 Design Build

The next delivery strategy is Design Build (DB) whereby the Owner contracts with a single entity that both designs and constructs the project. The owner must develop a conceptual design or provide performance specifications. Planning, Finance, and O & M still remain segregated under separate contracts or sources. This form of delivery is similar to that of a traditional Master Builder. Federal Acquisition Regulations now allow use of a restricted, two-step version of DB. (FAR 36.301).[9] Under this regulation, the "scope of work may include criteria and preliminary design, budget parameters, and schedule or delivery requirements."[10] The two steps involve qualification of DB teams based on technical approach and qualifications and then evaluation of proposals from qualified teams. The military has used this strategy sparingly.

2.1.2.3 Design Build Operate

Design Build Operate (or Design Build Operate Maintain) is a delivery strategy in which the Owner enters into a single contract for design, construction, maintenance and operations. Funding for all or a portion of these services is provided directly from the Owner or in equivalent of cash payments, such as the right to collect rent. Such is the case in the Navy's Public Private Ventures (PPVs) where some capital costs and the right to collect rents from tenants is provided by the government. These PPVs are the only forms of DBO available as authorized under the Fiscal Year 1995 and Fiscal Year 1996 National

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[9] Statute basis for this Regulation was established under the Federal Acquisition Reform Act of 1996 and codified at 10 U.S.C Section 2305(a) and 41 U.S.C Section 303M.

Defense Authorization Acts.[11] Authorization for use is limited to housing delivery and expires on 10 February 2001.

The overused term "privatization" is often used to describe the Navy's Public-Private Ventures. However, privatization is only represented in the following delivery method termed Design Build Finance Operate, in which full ownership and financial support of a project and its resulting facility or system are required. Privatization does not include a partnership or corporations where the owner is still vested in the project. (Miller 2000b)

2.1.2.4 Design Build Finance Operate

The most integrated form of delivery strategy is Design Build Finance Operate (DBFO or BOT) method. This is similar to DBO except that government funds are not appropriated for any services throughout the entire contract term. This absence of any form of subsidy is what distinguishes this delivery method from DBO. The project must be wholly sustainable through the providing entity's own financial strength and revenues generated from the facility.

The last project delivery method to be addressed is Operations and Maintenance (O & M). This method is used to provide routine operation, repair and maintenance to facilities created under DBB and DB contracts. Navy bases generally have a single O & M contract that covers all infrastructure facilities called a Base Operating Support (BOS) Contract. A facility produced under DB or DBB will generally be incorporated into the existing, local BOS contract via contract modification.

The following chart illustrates the life cycle chains available by which individual projects can be executed through the delivery methods described above. Access to all of these delivery options is the first step in sustainable portfolio management. Currently, special legislation is required to use the systems approaches available in DBO and DBFO (or BOT) scenarios.

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[10] Under the ABA's 2000 Model Procurement Code, the functional requirements establish in a DB solicitation are called Design Requirements.

[11] These Acts are codified at 10 U.S.C. Section 2871-2885 (1996).

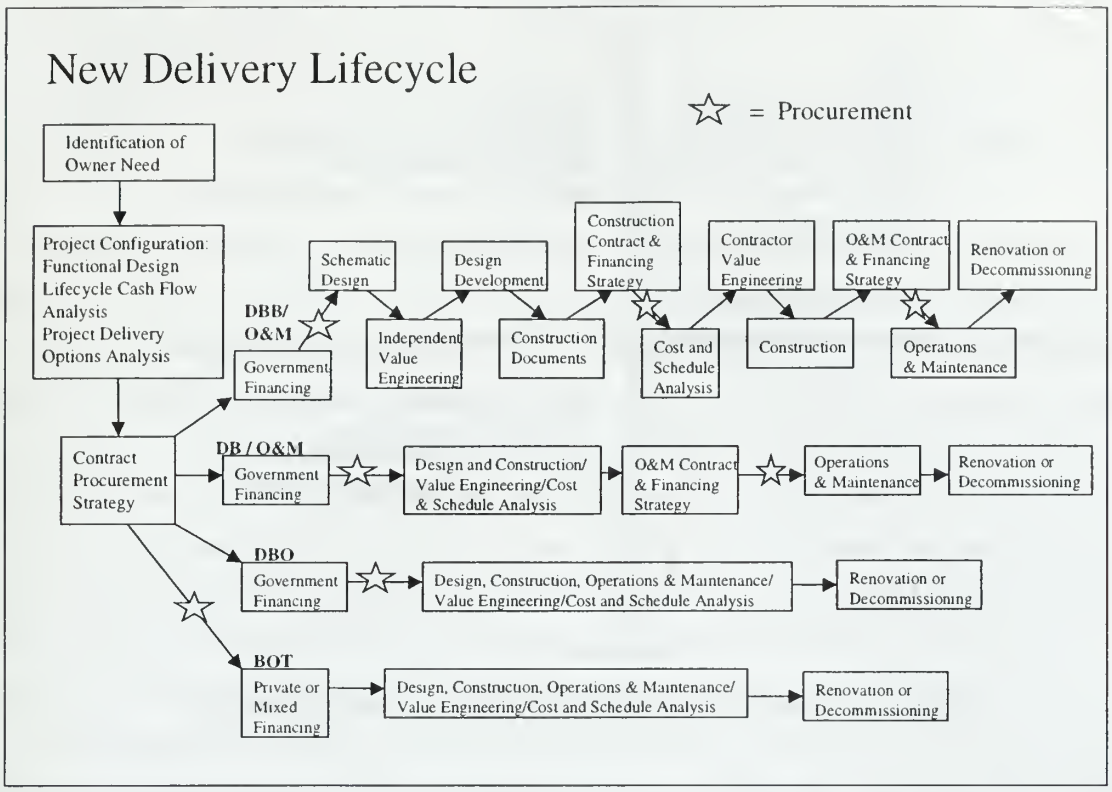

Figure 2-3: Project Life Cycle Supporting Multiple Delivery Methods (Mahoney 1998)

2.1.3 The Quadrant Framework

Professor John B. Miller at the Massachusetts Institute of Technology developed the Quadrant Framework shown in Figure 2-4 by which to classify projects in terms of delivery and finance methods. The framework consists of two axes representing Integration of Delivery and Source of Finance. The horizontal axis classifies delivery methods by integration level of the major lifecycle elements of design, build, and operate. Projects are largely distinguished on the basis of O & M integration which has the greatest cost impact on the life cycle of an infrastructure facility. The vertical access defines the degree to which direct, government finance is at risk.

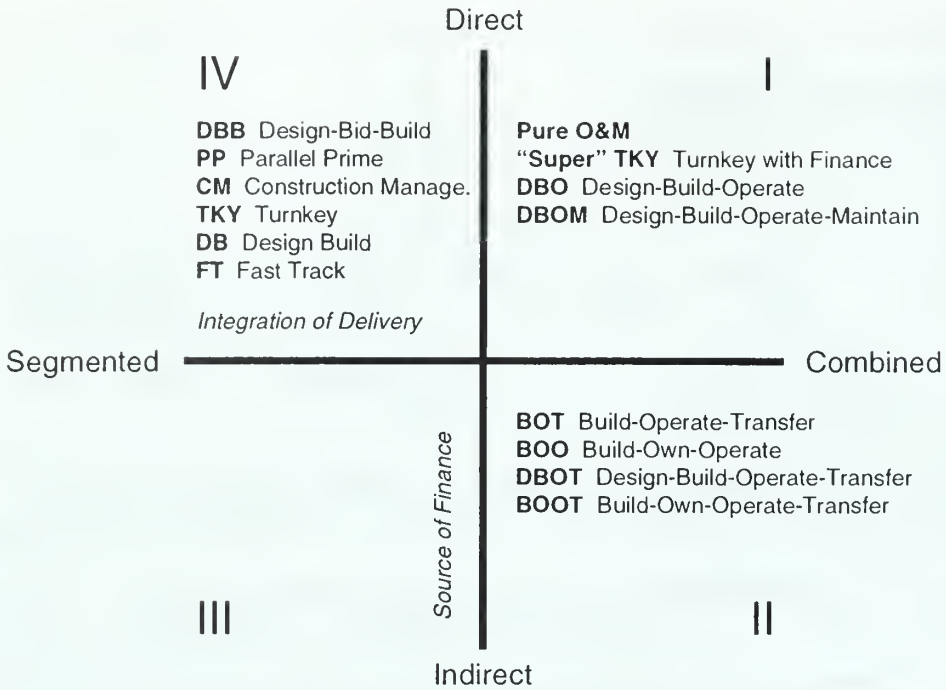

Figure 2-4: Operational Framework for Project Delivery Systems (Miller 1995)

Most current government acquisition is executed in Quadrant IV. However, this has not been the case throughout United States' (U. S.) history nor that of many foreign governments. In the Pre-Depression era of 1789-1993, Quadrants I and II were used almost exclusively to delivery most of America's early infrastructure. In fact over 60% of all projects authorized by Congress prior to 1933 were delivered as franchises with indirect funding. Major projects of this nature in Quadrant II include the Brooklyn Bridge, the New York Subway, the Illinois Central Railroad, and the Keokuk Power Plant and Dam. (Miller 2000b) It is only since World War II that government acquisition has been "stuck" in Quadrant IV. This method was generally acceptable in the thriving U. S. economy where governments could fund most infrastructure needs directly. However, since 1980, federal support for major infrastructure programs[12] has waned, leaving state and local governments to bear the majority of life cycle costs. Now, mired in 50 years of legislation and regulation focused on directly funded, segregated delivery, the nation's great infrastructure is feeling the effects of an inflexible procurement strategy.

Professor Miller describes a "Dual Track" strategy, utilizing the advantages of Quadrants IV, I, and II. Here both private and public finance have historically been used to effectively combat the decay of existing infrastructure while providing expanding infrastructure frameworks that can grow with the

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[12] The federal government supported huge national infrastructure delivery programs with the Interstate Highway System and the Construction Grants Program. However, this left the majority of life cycle costs to rest with the states and local governments because delivery costs represent only 10-15% of total costs.

economy and direction of the nation. This is a levering strategy and relies on the simple fact that governments will never have enough revenue to fund infrastructure repair and growth requirements. Why utilize the strongest economy in the world, the economy our infrastructure supports, to provide essential support where feasible? A modern example of successful application of this strategy transpired in Hong Kong.

Recently, between 1987 and 1997, Hong Kong provided a balanced example of executing infrastructure projects in preparation for its return to the People's Republic of China. Their government took a portfolio approach to planning based on years of systems planning. They consequently executed a "Dual Track" strategy to accomplish a myriad of major airport, port, rail, subway, bridge, tunnel, public housing, water, power, solid waste and telecommunications projects. The pace at which these huge infrastructure projects were produced would not have been possible without use of such a strategy. Investment in fundamental elements[13] of procurement strategy thorough condition assessment, and a solid understanding of infrastructure activity costs, secured Hong Kong's potential to remain a leading Asian economic center in the 21st century. The government understood that establishment of modern infrastructure was a key element in local, regional, and international economic prosperity.

The following chart in Figure 2-5 depicts Hong Kong's recent distribution of projects with in Miller's Quadrant Framework. Hong Kong predominantly uses DBB and DB methods for 80% of their projects, but supplement with approximately 10% by DBO and another 10% by DBFO methods. (Miller 2000b) This is distinctly different from most of the base housing case studies in Chapter 4 in that the Navy is still limited to a "Single Track" strategy. Although the Navy is venturing into Engineering Systems Integration, they remain largely dependent on direct funding and segregated project delivery. Currently, the Navy's projected housing budget for new construction and improvements allows for 20% of projects to be executed by DBO in Fiscal Year 2002. This is projected to increase to 27% by Fiscal Year 2007.[14] (Shelton 2000)

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[13] Procurement strategy Fundamental Elements will be discussed further in Section 2.3.1

[14] This percentage is based on the leveraged value of projects assuming that "seed" moneys would represent 33% of project costs. The actual figure for PPV efforts represents only 7-9% of the projected budget.

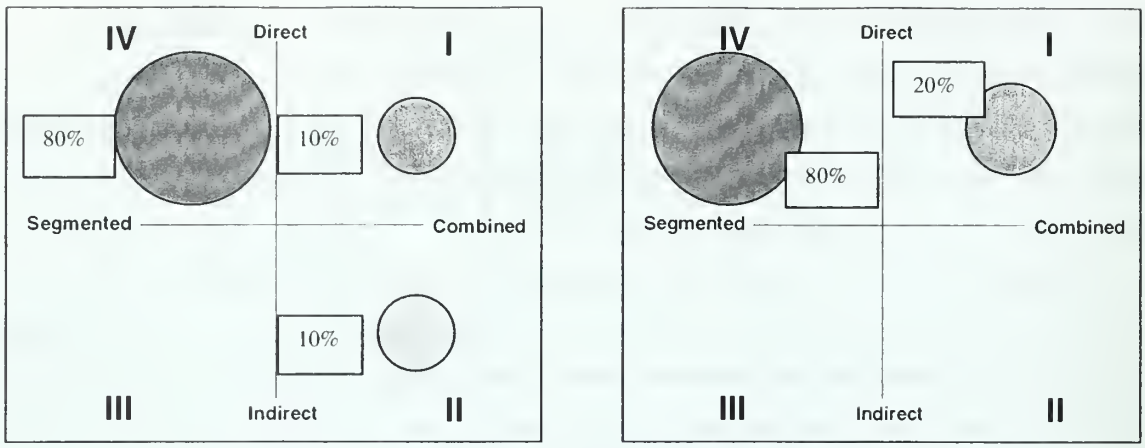

Figure 2-5: Hong Kong's Infrastructure comparison to Navy Housing Delivery Strategies

2.1.4 Cash Flow Analyses

Cash flow analysis is another essential tool for decision-makers in establishing robust capital programs. Cash flow models provide a common basis by which to compare delivery methods alternatives. They are essential parts of project development from both the owner and contractor points of view and should be analyzed regardless of what type of delivery method is finally chosen. Although the public and private perspectives are different, they need to understand each others' financial needs in order to make alternative delivery methods more viable. Discounted cash flow analysis is one such way to establish this common ground.

2.1.4.1 Why Net Present Value Leads to Better Investment Decisions than Other Criteria

There are several methods upon which to make real asset capital budgeting, or investment, decisions. The Net Present Value (NPV) Method provides clear advantages over other common methods.[15] Its foundation lies in the principle that "a dollar today is worth more that a dollar tomorrow." This rule leads to the concept of discounting in which Present Values are calculated through use of discount factors.

The Net Present Value rule states, "Accept investments that have positive net present values." The following four basic steps are followed in calculating an NPV solution for any problem or project evaluation:

- Forecast cash flows for the project over its entire life cycle.
- Determine the associated Opportunity Cost of Capital. Opportunity cost is the value foregone by investing in the project rather than in securities with an equivalent risk profile.

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[15] Brealey and Myers' Principles of Corporate Finance (2000), provides the basis for Net Present Value explanations presented in this thesis.

- Calculate the Present Value of the project by summing the cash flows discounted at this Opportunity Cost of Capital. The cash flows are discounted each period by the simple formula of:

$$\textbf{Present Value (PV)} = \textbf{Sum}[C_t / (1+r_t)^t].$$

Where **C** is a period **t**'s cash flow and **r** is the discount factor.

- Calculate the Net Present Value by subtracting initial investments or

$$NPV = C_o + PV$$

Where C_o is the initial outlay or investment.

Other financial analysis methods are used by managers in some cases and one should be able to understand their drawbacks when faced with associated evaluations. When comparing alternative analyses, it is useful to keep in mind that the NPV method has three superior elements. First, NPV takes into account the time value of money. Only the Internal Rate of Return method does the same. Next, the NPV analysis depends only on forecasted cash flows and the opportunity cost of capital. It is not subject people's bias, company policy or accounting method. Lastly, Present Values share the additive property of being measured in today's dollars, so you can sum individual projects together.

Competitors of the NPV approach are the Payback Period, the Book Rate of Return, and the Internal Rate of Return. The Payback Period is equal to the number of years it takes the cumulative cash flow to equal the initial capital investment. This method fails to account for cash flows beyond the cutoff date regardless of their outlook. In using this method, one could discard short-term projects in lieu of better long-term projects. The next method, the Book Rate of Return is a measure of book income divided by book assets. This method is subject to an accountant's classification of cash flows i.e. which items are treated as capital investments and how they are depreciated. Another problem with this method is that is relies on average profitability of past investments vice incremental projections. The last method is the Internal Rate of Return (IRR). This is a more accepted means of analysis, but still has weaknesses when compared to the NPV method. The IRR is the discount rate that makes a project's NPV equal to zero. It is a profitability measure related to the timing of cash flows. The IRR Rule is to accept an investment if the opportunity cost of capital is less that the IRR. Erroneous results can occur with the packaging of projects or when cash flow signs change more that once. However, if used wisely in full knowledge of the conditions that produce misleading results, the IRR method can be used successfully. For these reasons the NPV method of analysis is considered superior.

More variables come into play when there are limitations on an investment program that prevents the owner from undertaking all viable projects. This state is called capital rationing and is a constant in the realm of public infrastructure management. Therefore a means of selecting a portfolio of project packages that make the best use of constrained resources is key.

2.1.4.2 Making Investment Decisions with the Net Present Value Rule

Net Present Value merits lend themselves well to assessing projects and portfolios. However, applying the method consistently to available cash flow data is very important. Several rules help to maintain the integrity of these analyses. First, the NPV method relates to cash flow vice profits. Cash flows should only be recorded when actual monetary transactions take place instead of when the work occurs. Next, construct cash flows on an incremental basis and include all incidental effects. Remember to include all downstream effects of such investment instead of just historical averages and look at the investment decision's effect on its on its entire system. All projections should include working capital costs. In terms of facilities, these Operations and Maintenance costs can be much more significant than initial outlays. Next, sunk costs are irrelevant and cannot be affected by future cash flows. So do not base investment decisions on money already expended. Fifth, other than cash portions of investments should be considered. For example, Navy land that would otherwise go unused or offered to another Agency can be used as leverage in Limited Liability Corporations. Next, treat inflation consistently. This translates to using either nominal or real terms for forecasting and discounting cash flows. Do not mix the two methods. Nominal rates do not take into consideration the rate of inflation. They relate to real rates through the equation:

$$1 + r_{nominal} = (1 + r_{real})\,(1 + \text{inflation rate})$$

These rules are applied throughout development and usage of the CHOICES© software that will be explained in the next section.

2.1.5 CHOICES©[16]

"Engineering Systems Integration" treats project delivery and finance methods as variables to be managed in the infrastructure development process. (Miller 1997a) This diverges from the current paradigm where public engineers and decision-makers think almost exclusively in terms of DBB. Most public officials have been stymied by regulations that have kept them from using other tools or are too comfortable with the current system to apply new methods. This new paradigm recognizes the strengths of both the public and private sectors and promotes synergy by applying their respective strengths in different delivery and finance methods. CHOICES© was developed to model the Engineering Systems Integration concept as a decision support tool in keeping with Ten Fundamental Elements of public procurement strategy. The Ten Elements will be discussed further in Section 2.3.1.

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[16] CHOICES© was developed at the Massachusetts Institute of Technology (MIT) and is copyrighted by MIT (1997,1998, 1999). MIT reserves all rights to the software. CHOICES is based on Microsoft Corporation's EXCEL 97/98©™ enhanced with Visual Basic macros.

This software-based decision support tool is used to develop scenarios for portfolios of projects based on project delivery, finance, and level of investment. It is based on project life cycle cash flows that vary with these controls. By varying delivery methods and finance alternatives at the project level users can view their effects at the portfolio level.

2.1.5.1 Structure of CHOICES©

CHOICES© software application is constructed of several layers of data input, control input, manipulation tools, and presentation graphics. The system is based on linking Microsoft Excel workbooks together. At the base level, workbooks are established with 1) Historical and Operating Data and 2) Project Data. Numerous delivery method configurations as described under Delivery Method Descriptions, Section 2.1.2, can be configured for each project. These workbooks are linked to a portfolio analysis "Chooser" which aggregates cash flows from the individual projects based on the user's choice of delivery configurations. Also at the workbook level are controls such as finance rates, operation and maintenance rates, and project costs and timing. These controls can be manipulated to conduct sensitivity analysis. The following Figure 2-6 illustrates the general structure of CHOICES©

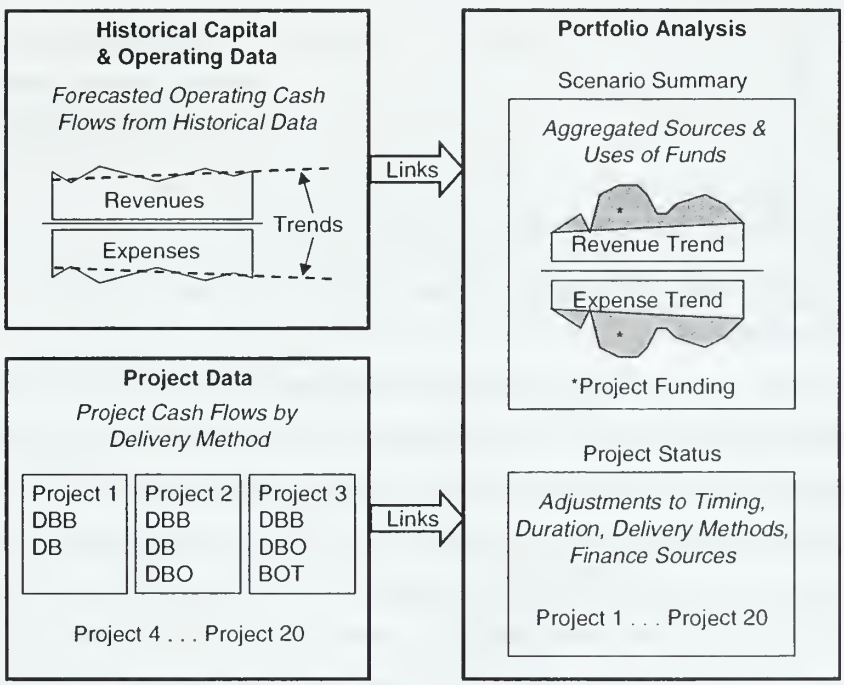

Figure 2-6: CHOICES© Components (Miller 2000)

2.1.5.2 Historical Data

Historical data consists of all sources and uses of funds from an owner. The owner may define the types of accounts categorized which helps to support activity based accounting. The program then calculates future trends using regression techniques. When necessary, the user may override the projections if more accurate data is available. Navy-specific inputs are detailed in Chapter 4.

2.1.5.3 Project Data

A portfolio of up to twenty projects can be entered into a CHOICES© folder of four workbooks. The user can enter up to five delivery types for each project. Specific cash flows for each of the project configurations chosen (DBB, DB, DBO, DBFO, and O & M) can be generated using unique templates modeled from historical data. An example of a DBO template can be seen in Figure 2-7. Additionally, each configuration can be modeled using different sources of equity or debt. Equity is distributed in order of subordination. Debt service is calculated for bonds, construction financing, and permanent financing. The user may supply variables such as interest rate, debt term and principal amount. Other project variables include discount and inflation rates, operations and maintenance rates, project cost, project start times and project duration. CHOICES© also forces consideration of debt service and operations and maintenance cost associated with capital costs. The corresponding revenue cash flows for these expenses are captured in two accounts called "new resources" and "user fees." The level of "user fees" generated may be set manually and any resulting revenues generated will offset total "new resources" required.

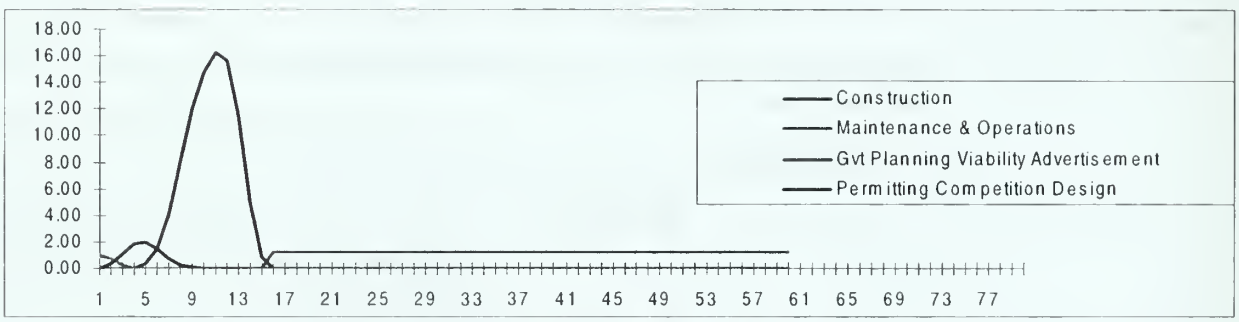

Figure 2-7: Typical CHOICES© DBO "Stretcher" Modeling Project Expenses[17]

2.1.5.4 Portfolio Analysis

Portfolio analysis is available in the "Chooser" workbook where cash flows from individual project configurations are aggregated. Project configurations can be manipulated to optimize financial outlays or other programming constraints such as pace, timing or funding types.

Figure 2-8 below illustrates a how the "Chooser" displays portfolio cash flows. Historical data is viewed to the left of the programming decision point. From this historical data, Operating Revenue and Expense Projections are made for the future and referred to as Project 0 or "P0"projections. New Capital requirements based on project configurations are displayed above and below the "P0" projections. A series of configurations for each case study in Chapter 4 can be view in a similar format. The "Chooser" worksheet, displays separate types of revenue and expense cash flows by color code in the graphs as well as numerically in a table and histogram.

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[17] This is an example of a DBO template where function of planning, design, and construction overlap. Other templates for DBB, DB, and DBFO have varying degrees of overlap and magnitude.

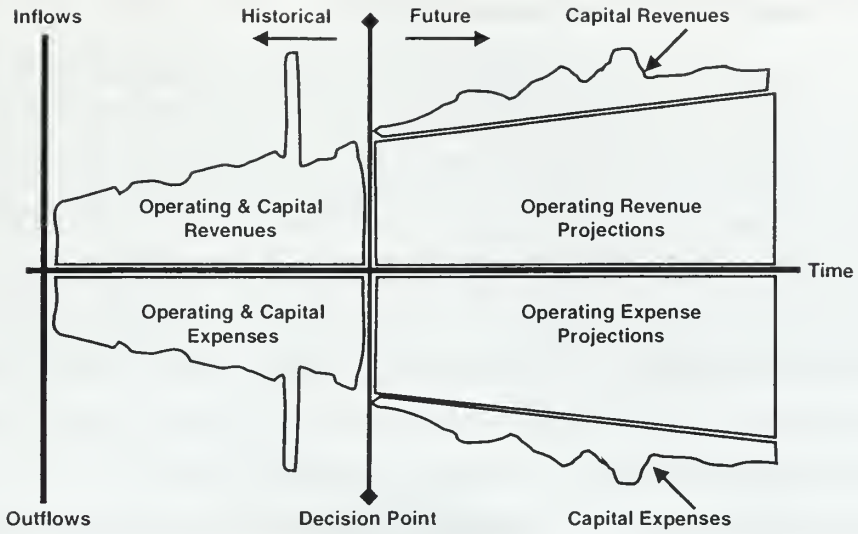

Figure 2-8: Typical Presentation Graphic from CHOICES "Chooser"

Configurations of project packages should be made for viable delivery types. Eliminating inappropriate means of execution is one of the keys aspects of this process. This can be done initially based on the owner's knowledge of funding constraints or after initial portfolio development and further cash flow analysis. Project level and portfolio level analysis can be conducted to determine if revenue streams associated with different delivery method configurations are viable. Once, non-supportable methods are eliminated the owner can further manipulate the project configurations and thus the overall portfolio through changes in delivery method choice, project scheduling, interest rate and O & M controls, and changes in funding sources. Overall pace, the level of funding, will have the most significant effect on portfolio configuration. For differing levels of pace, entirely different project delivery methods may be required to enable the desired tempo of execution.

CHOICES© is a dynamic infrastructure portfolio planning tool that is based in Engineering Systems Integration. The focus on cash flows associated with an entire portfolio will provide public owners a better understanding of project viability and life cycle costs, and establish an objective evaluation method for comparing all projects within a portfolio. (Miller 1997c) Its flexibility in presenting the effect of numerous project configurations at the portfolio level can aid infrastructure planners in developing robust strategies.

2.2 Method of Selection for Individual Projects

Another set of tools by which to select construction project delivery methods is proposed by Mr. Christopher Gordon of the Massachusetts Port Authority.[18] While he acknowledges the benefits of typical DBB methodologies, their predominance is diminishing as technology, finance and contracting methods advance to meet more demanding requirements for growth. The basis of his outlook is that no one method is superior and that smart infrastructure managers and strategists will explore the advantages of alternative contracting methods in light of each project's unique drivers. His methodology for evaluating contractual structure seeks first to eliminate those methods not suited for specific owners or projects in the context of current market forces. This is a dynamic system that when consistently applied over time will produce a more robust portfolio than reliance on a predetermined contract method.

Gordon frames construction contracting methods in the context of four categories: scope, organization, contracts, and award method. First, scope is defined as the level of integration of life cycle elements assigned to a contractor, i.e. what portion of design, build and finance is being assumed. Next, the organization is defined as the business entity with which the owner has a contract. These organizations a are defined as General Contractor, Construction Manager, Multiple Primes, Design-Build Team, Turnkey Team, and Build Operate Transfer Teams. Two terms that may require clarification are Construction Managers and Turnkey Teams. Construction managers act as consultants or managers for an owner. They can operate as a fiduciary of the owner or be put "at risk" where they play a role similar to General Contracting. Turnkey Teams are simply Design Build teams that offer construction finance. "Take out," or long-term finance, must be provided by the owner as the Turnkey project is paid for in lump sum upon completion. Third, is the contract itself which defines the method of payment. Some examples include lump sum, unit price, cost plus, guaranteed maximum price (GMP), and fixed fee. Lastly, award is the method or criteria by which the contractor is selected. Together these components can be configured to form the same methods describe in Delivery Methods as DBB, DB, DBO and DBFO (or BOT).

The most common, publicly used method is DBB which has a proven record over the past fifty years. It provides predictable results through separate procurement of each scope element. The owner enjoys a fiduciary relationship with the designer and has a set price prior to start of construction. However, this method has several systemic problems. The segregated structure of scope often instigates argumentative relationships between all parties. Next, the low-price atmosphere often leads to quality

[18] Mr. Gordon lectures at the Massachusetts Institute of Technology, teaching a course titled, "Innovative Project Delivery in the Public and Private Sectors."

issues and modification contests. However, most importantly, it neglects the time, innovation and life-cycle cost advantages that might be available in other methods.

Gordon established methods by which inappropriate methods can be eliminated. First, the owner must have a good understanding of general project scope, budget constraints, and timing requirements. Once these are established, a methodology addressing Project Drivers, Owner Drivers, and Market Drivers can be used to highlight possible methods. By combining this input with judgement and risk assessment, contracting methods and award methods can be selected to complete the contractual package. The overall goal is to balance market, product and process systems in a strategic triad as illustrated in Figure 2-9.

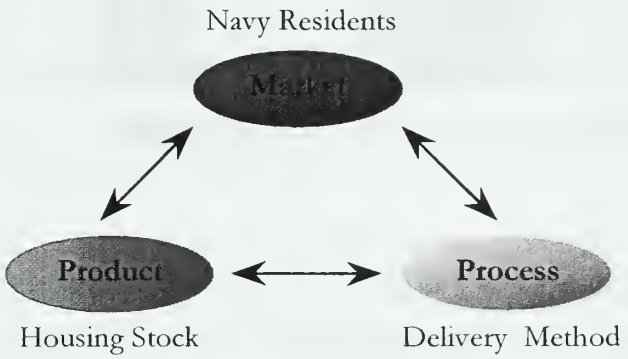

Figure 2-9: Strategic Alignment for Navy Housing Delivery

2.2.1 Project Drivers

Choosing an appropriate organization and scope occur concurrently. Organizations are built to support different delivery methods. Three driver-types are explored that allow owners to hone in on specific contract methods. The first of the three methods looks at Project Drivers. These can be assessed and tabulated in a framework like that in Figure 2-10 to determine which contract methods should be eliminated. Specific project assessment is based on time constraints, flexibility needs, pre-construction needs, degree of design interaction, and financial constraints. Checks under a column representing a specific organization indicates that a row's requirement can be met with that configuration. For example, the top check under CM (Construction Manager) indicates that this method can be employed to execute a Fastrack Schedule where design and construction overlap. In highlighting owner requirements (rows) organizations (columns) can be eliminated where "checks" are not present. In the example provided, highlighting rows for desired requirements of an unknown project yielded potential organizations highlighted by "slants." For this example, this process eliminated two thirds of the possible organizations.

Drivers	GC-FP	GC-R	CM	MP	DB-FP	DB-R	T-FP	T-R	BOT
Fastrack Schedule		•	•	•	•	•	•	•	•
Sequential Schedule	•	•	•	•	•	•	•	•	•
More Flexibility		•	•	•		•		•	
Less Flexibility	•	•	•	•	•	•	•	•	•
Pre-Const. Advice Needed		•	•		•	•	•	•	•
No Pre-Con Advice Needed	•	•	•	•	•	•	•	•	•
Design Interaction	•	•	•	•		•		•	
Less Design Interaction	•	•	•	•	•	•	•	•	•
Construction $ Needed							•	•	•
Permanent $ Needed									•
Owner Financing	•	•	•	•	•	•			

Figure 2-10: Project Driver Matrix (Gordon 1994)[19]

2.2.2 Owner Drivers

The next set of drivers relies upon the capabilities of the owner to further define the types of potential contract methods. These are more subjective than Project Drivers and often rely on the owner's judgement. Determinates include construction sophistication, current staff capabilities, risk aversion, restrictions on methods (i.e. regulations), and external factors such as strategic or political issues. Method restrictions and external factors will have the most significant impact. The following charts, Figure 2-11 and Figure 2-12, depict the capability and capacity of the owner to manage certain methods. Here the example horizontal lines segregate which methods (above the line) would be inappropriate for the owner at that point in time.

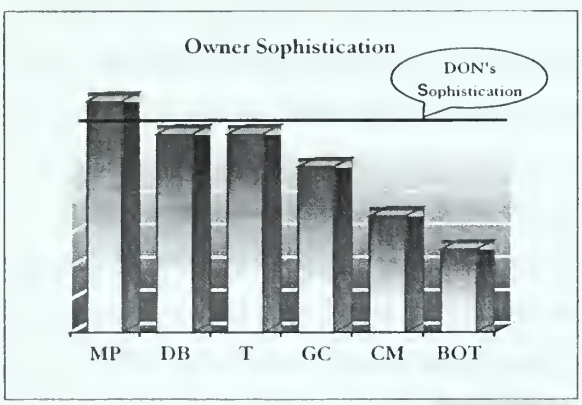

Figure 2-11: Owner Sophistication Graph (Gordon 1994)

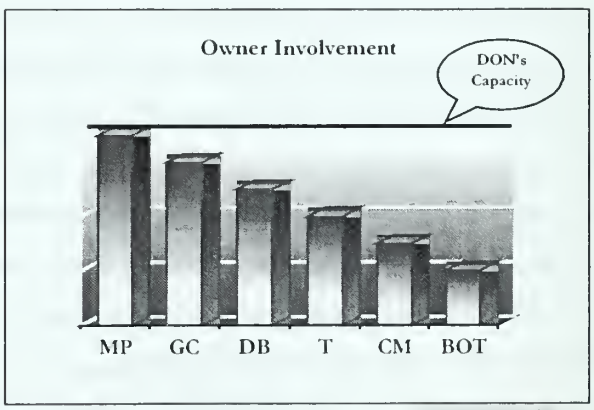

Figure 2-12: Owner Involvement Graph (Gordon 1994)

[19] Abbreviations include: GC = general contractor, FP = fixed price, R = reimbursable, CM = construction manager, MP = multiple primes and T= turnkey. These and other definitions can be found in Gordon's 1994 ASCE article titled, "Choosing Appropriate Construction Contract Method."

2.2.3 Market Drivers

Another set of drivers that can help to shape a desirable organization for a project are Market Drivers. The major elements are 1) availability of appropriate contractors, 2) current state of the market, and 3) project package size. The first can aid in establishing organization and the second and third can help to determine appropriate contract structures. First, since the construction market is so segmented, the owner needs to determine if there are contractors available in the area that can support adequate competition for the proposed organization method. Next, the local and regional markets must be assessed to determine how to compete the solicitation. The degree of competition in the current market will affect timing and solicitation decisions. Lastly, the project package size needs to be attractive to the local market. Repackaging a project in a growing region with large contractors may support aggregated packages whereas more remote sites may lend to smaller package sizes to optimize market efficiency. Larger package sizes lend to more integrated delivery systems such as DBO and DBFO where the marker will support them.

2.2.4 Commodity v. Services

The contracting vehicle chosen, i.e. the method by which to pay the contractor[20], should be based on risk allocation. Ideally, a healthy balance of risk should be shared contractually between the owner and contractor. By allocating risk to the party best able to control it, cost savings is maximized by reducing contingency requirements. A thorough process of assessing, allocating and managing risk should be the basis of the contract. Contract types will vary in accordance with such assessment from fixed-price where the contractor bears most risk to reimbursable where the owner bears the majority of risk. There are many variations between the two extremes. One of the most common hybrids for sharing risk is the Guaranteed Maximum Price contract by which the contractor is reimbursed up to a set point beyond which the contractor is responsible for costs.

A chart similar to that depicted in Chapter Four's San Diego Case Study is often helpful to make the owner's risk objectives transparent and to address allocation and management of major risks. The first step is to identify the major sources of risk that will affect project cost. Generally, the largest source of risk is the degree of completion and quality of design. Other major risks include permitting, unknown site conditions, life cycle element issues, finance and market factors. Next, the identified risks should be allocated to the party that can best control them. While owner's tend to push most risk toward the contractor, often the owner has more control over certain factors. In these cases, the owner can save

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[20] As defined by Gordon's framework.

money by assuming responsibility where the contractor would need to establish contingency commensurate with the risk. One example of splitting risk allocation fairly is to assign unit prices to sub-surface work where risk of unknowns is high and cover the above ground, more controllable, portions of construction under lump sum clauses. Once the risk is allocated, there needs to be an adequate system in place to manage the risk. For example, if the owner elects to take on a great deal of risk through a reimbursable contract, s/he needs to have the staff and tools to closely monitor cost, progress and quality.

2.2.5 Award Methods

The final step in assembling an appropriate contract delivery method package is to determine which source selection method is best suited to the project type. This generally should be based on whether the project commodity or service oriented. Public agencies tend to treat all projects, regardless of their nature, as commodity contracts whereby price and very basic qualifications is the sole basis for award. This method assures competition and a transparent, fair process. However, after award, contractor responsiveness and work quality often suffer under DBB contracts. On the other extreme are sole-source negotiations where competition is disregarded. Infrastructure delivery is often a mixture of commodities and services where technology and products are always increasing in complexity. A positive example is the Navy's DBO housing contract in San Diego which requires new construction of standard homes, but also requires financial, design, operations and maintenance, and property management services. In this case, the Navy utilized competitive negotiations system involving separate qualification and proposal rounds. See Chapter Three for further discussion on this process.

2.2.6 Conclusion on Contract Method Selection

Owners have the responsibility for establishing a competitive procurement system by which to execute their project and portfolio needs. Understanding the components that make up appropriate contracting methods is the first step in matching the right system with individual projects. By using the drivers, risk analysis, and commodity verses service analysis, the best options can be made more visible. There is no substitute for owner judgement in selecting delivery methods, but exploration of alternative methods through a systematic and dynamic methodology can add value to any public entity's portfolio delivery.

2.3 Strategy

Competition is the foundation for robust infrastructure development as well as the basis of all industries that drive flourishing economies. Professors Miller and Porter[21], have devoted a significant portion of their careers defining ways to structure competition focus into strategy at the industry, firm and government levels. Professor Miller's Fundamental Elements define ten essential principles to building success in the public infrastructure arena. Professor Porter's emphasis is focused on the microeconomic activities that allow efficient private sector productivity. He maintains that firms, not countries, drive economies. In implementing public infrastructure development, it is essential to have a solid understanding of the factors that drive both the private and public sectors and their mutual dependence. How this core relationship is structured through respective strategies will determine the productivity, or wealth, of cities, regions, and nations.

2.3.1 Fundamental Elements of Infrastructure Strategy

In the past fifty years, American public infrastructure has strayed from the valuable growth lessons learned in our pre-Great Depression eras. The goal of infrastructure development should always be to attain essential, innovative, high-quality, cost-effective projects that satisfy the nation's needs for growth and renewal. Attaining these goals through segmented delivery methods and direct finance has been and will continue to remain inadequate. A balance must be struck between public and private sources of delivery in order to achieve these high ideals, and at the same time satisfy government, private industry, and taxpayer objectives. This is only possible through return to a balanced system of delivery and finance where the strengths of the public and private sectors can work together to provide attractive business opportunities and corresponding innovative, high-quality, cost-effective services. Professor Miller pens a set of principles called Fundamental Elements that provide the foundation to successful infrastructure strategy.

2.3.1.1 Client Defined Scope

An effective infrastructure strategy must be based on an effective combination of condition assessment and projection of requirements to support growth. Unless agencies understand what they need and program specifically to achieve certain goals, there is no basis for strategic planning. Governments must have the tools and the knowledge base to define what they require so that an appropriate strategy can be forged to accommodate those needs. Without defined scope, whether it be by performance specification or full design, there exists no basis for competition. Simply inviting the private industry to come and repair public infrastructure systems will yield an infinite number of incomparable solutions.

2.3.1.2 Head to Head Competition

Once a well-defined baseline of scope is determined, competition can take place that ensures the most qualified providers are awarded contracts in return for their cost effective, innovative ideas and services. Only through open competition will the best prices, most innovative technology and quickest delivery be brought forth. America's amazing growth and renowned ability to innovate is based on fierce competition. It is an inseparable part of any procurement strategy.

2.3.1.3 Fair Treatment of Actual Competitors

The past fifty years of public acquisition statutes and regulations has centered on providing a "level playing field" upon which providers can compete. Rules must be established before contract award and be sustained throughout the life of the contractual relationship. Solid commitment by an agency to make firm, fair and predictable rules of engagement attracts competitors. Changing rules to meet the owner's political or personal agenda has no place in public procurement. There is no faster way to break faith with industry and the taxpaying public. Modern public contracting agencies hold this in such high regard that strict regulations are in place to prevent even the appearance of bias or mishandling of public competitions.

2.3.1.4 "Transparency"- Signaling Fair Treatment to Potential Competitors

Transparency suggests that the procurement system in place can be seen and understood before a firm commits to engaging a competitive solicitation. The government must clearly present selection criteria so private firms are willing to risk their valuable time and resources in bid or proposal preparation. Only in a transparent process can contractors be assured that their most innovative and cost effective ideas will work to their advantage in winning the award. Transparency is increasingly important in integrated procurements where competitors can expend up to $1.0 million dollars in proposal preparation alone. Teams and corresponding proposals are assembled to win keen competitions by aligning tightly with solicited criteria. If the rules change mid-stream, contractors will be unlikely to return to such costly competitions, thus hampering agency, infrastructure and private firm advancement.

2.3.1.5 "Safety"- An Independent Check on the Efficacy of Design

Professional Engineers and Registered Architects have long been engaged to oversee the design of public infrastructure projects to ensure safety and technical effectiveness. This is one of the founding themes in the segregation of design from construction whereby the professional qualifications of design professionals and their fiduciary relationship with owner is held in high regard. The essence of this notion serves to put public safety above cost and other efficiency factors, however, there are systemic

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[21] Michael E. Porter's trilogy of books including, Competitive Strategy, Competitive Advantage and Competitive Advantage of Nations provide the basis for discussion in this section.

problems with this arrangement as well. The major drawbacks include built-in contention with builders and operators, less focus on constructability and operability, and a singular approach to each design requirement. In more integrated delivery methods where the owner does not enjoy such a close relationship with the designer, the same safety and technical feasibility benefits can be reached through an independent check. Hiring a third party engineering firm also has the added benefit of providing benchmarking cost estimates and technical solutions in addition to checking original work of DB, DBO and DBFO teams. This practice lends itself to industry improvement while introducing more engineering firms to alternative delivery systems.

2.3.1.6 Competition Open to Technological Change

America's rise as the world premier economic power has been based on diversity and drive to innovate. Change driven by innovation is a powerful constant in our economy. Procurement policy needs to embrace this great potential and provide systems that reward innovations that improve infrastructure development and maximize costs savings. Reliance on federal specifications and other inflexible design parameters will stifle advancement and discourage the private industry from participating in public procurement. Procurement through segmented life cycle elements will deny innovative opportunity otherwise available through life cycle approaches that enables incremental improvements and economies of scale. It is private sector structure, drive and capacity that unleash innovative ideas and systems improvements where inflexible government structure cannot. Agencies must do more to promote such opportunity rather than further define regulations cementing insular, pre-determined delivery methods.

2.3.1.7 Sound Financial Analysis Over the Project Life Cycle

As discussed under Cash Flow Analysis, the importance of life cycle cost analysis is invaluable to infrastructure development. Using discounted cash flows forces engineers and decision-makers to consider the long-term effects of their project decisions and actions rather than focusing only on development costs. They also provide a standard framework to compare alternative delivery methods for individual projects. In this context, the nature of short-term political decisions can be influenced by the wide-angle lens approach offered from cash flows analysis. All too often, those with the power to program or approve project funding are unfamiliar with the long-term nature of infrastructure processes and manipulate short-term development funds without regard for downstream or system effects. Discounted cash flow analysis is one way to standardize how projects are analyzed and presented. Their use will promote alternative delivery methods and educate decision- makers on life cycle issues.

2.3.1.8 Dual Track Strategy

The basis of Professor Miller's Quadrant Framework is to establish different delivery and finance methods as variables in a procurement program. The Dual Track strategy relies on 1) direct government funding and 2) private or indirect funding to be used synergistically within a project portfolio. No one

system is optimal through time or types of projects. History has proven this, yet the past fifty years of legislation continues to make segregated, direct finance mandatory unless otherwise specifically authorized. A model procurement code that defines the basic alternative delivery and finances has been developed and should be adopted by federal, state and local agencies. Wide acceptance of such a standardized system would at least provide agencies the power to explore project planning and execution options without requiring exhaustive special legislation for individual programs or projects.

2.3.1.9 Scenario Building for Portfolios

Cash flow analysis and the power to choose finance and delivery methods give engineers powerful tools with which they can build and optimize infrastructure portfolios. Strategic planning is enhanced through the use of software simulations that can illustrate the effects of diversified project execution methods. Without such tools, agencies are likely to remain in the current development paradigm as they will be less able to convince decision makers of the merits of "new" methods.

2.3.1.10 Pace

Pace is the rate at which infrastructure renewal and development are carried out. Often, pace is at such a low level that infrastructure progress appears to be regressing. This is largely a structural problem brought about by the requirement to use direct funding for projects where a dearth of such funding exists. There will rarely be enough funding allocated from a scarce pool of public resources to properly support infrastructure renewal and development. Governments must look to alternative delivery and finance in order to support an effective pace.

2.3.2 Competitive Strategy

Competitive Strategy, the first book in the Porter trilogy, concentrates on competition and its role in company performance within industry. "Competitive strategy is the search for a favorable competitive position in an industry, the fundamental arena in which competition occurs." (Porter 1985, pg. 1) There exist two main components to success in an industry: attractiveness and relative competitive position. Attractiveness is the potential of a market for sustained profitability. Competitive position is how a company is structured to perform relative to others within the same industry. Firms can effect both attractiveness and position through competitive strategy. Porter lays out several analytical frameworks that are useful in formulating strategy. The two basic frameworks discussed include "five competitive forces" that determine attractiveness of an industry and "three broad generic strategies" for achieving competitive advantage.

Competitive advantage is the ability of a firm to profitably create value for its clients. Firms can create and sustain competitive advantage by using such frameworks to understand industry structure and

then to bridge between strategy and implementation. Governments need to understand the same principles so that they can create an "attractive" environment in which competitive firms can thrive.

2.3.2.1 Five Competitive Forces

Attractiveness of an industry segment is based on the forces of competition acting upon it. Only through understanding the forces can a firm manipulate them or position itself more favorably through its competitive strategy. Figure 2-13 illustrates Porter's Five Forces. In industries where these forces are favorable, numerous firms can earn high profit margins. Where one or more of these forces is too strong, few, if any, firms can be successful. The structure of these forces in an industry will determine profitability as they influence prices, costs, and levels of investment. This is a very dynamic system in which any firm or government can significantly affect industry attractiveness through execution of their competitive strategy.

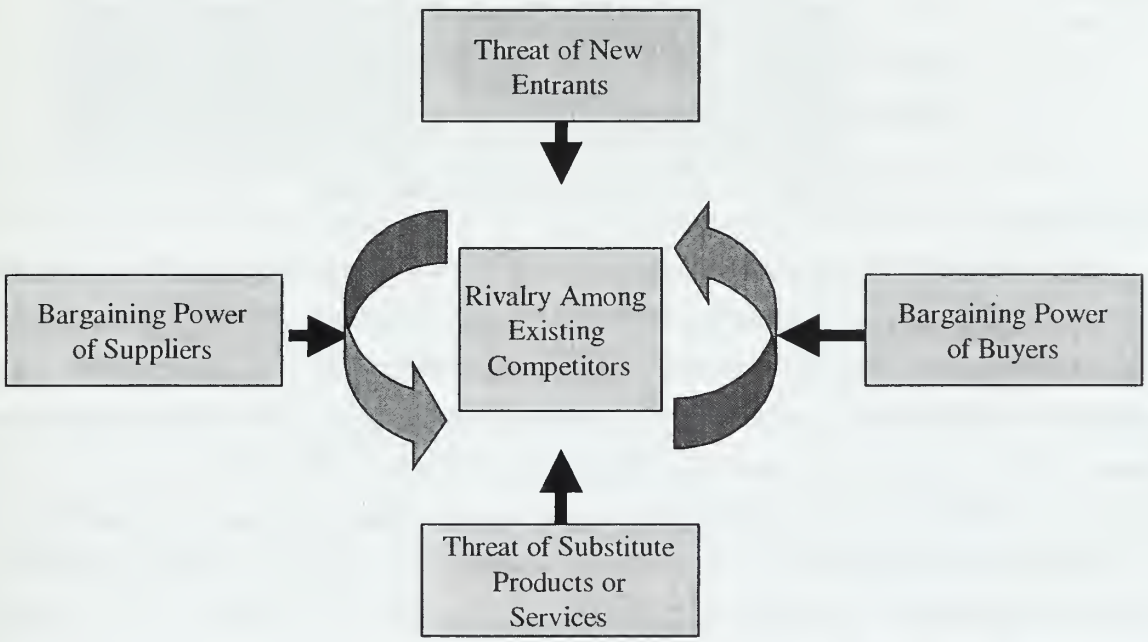
Threat of New Entrants
Bargaining Power of Suppliers
Rivalry Among Existing Competitors
Bargaining Power of Buyers
Threat of Substitute Products or Services

Figure 2-13: The Five Competitive Forces that Determine Industry Profitability (Porter 1985)[22]

2.3.2.2 Generic Strategies

The second core concept in developing competitive strategy is formation of a generic strategy. Generic strategies determine a firm's position and profitability within an industry. Establishing and implementing a generic strategy well can yield above average performance even within an unattractive industry segment. In order to sustain high performance, a firm must have a competitive advantage in 1) low cost or 2) differentiation. Advantage in either stems from industry structure and the firm's ability to choose an industry segment and manipulate five forces better than its rivals.

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[22] Detailed explanation of the five forces determinates can be found in Porter's book, Competitive Strategy.

Gaining competitive advantage requires execution of one of the strategies illustrated below in Figure 2-14. Here cost or differentiation leadership is applied over a broad range of industry segments or focused in narrow segments. Achieving any one of these can lead to competitive advantage only if the company firmly chooses to follow one strategy. "Straddling the fence" between two strategies will lead to poor performance in both.

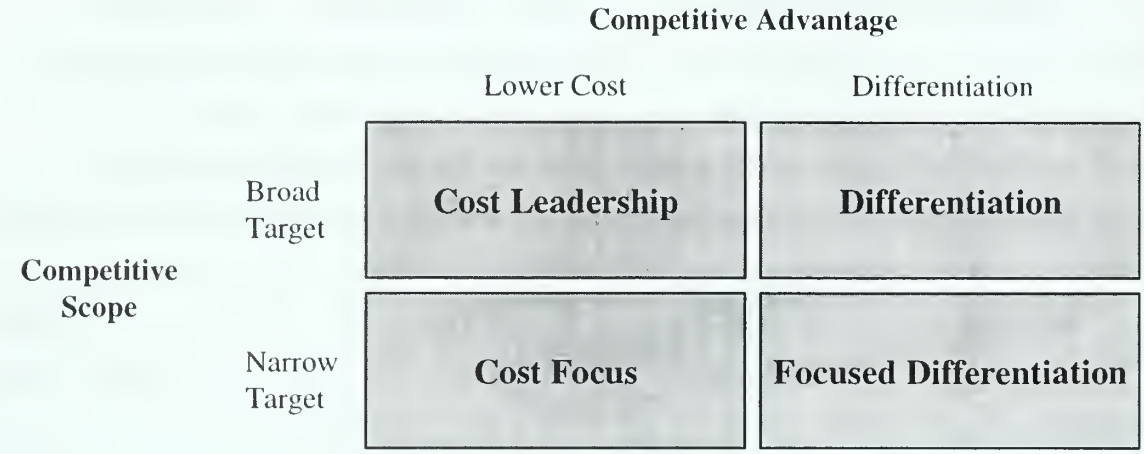

Figure 2-14: Three Generic Strategies (Porter 1985)

Cost Leadership

Cost leadership is the clearest of the generic strategies. Low cost is an objective way to measure performance. The sources of cost leadership depend on the industry. Some examples include economies of scale, proprietary technology, better logistics (supply chain) management, or cheaper raw materials and components. Another source of cost advantage lies in reshaping the supply chain to cut out unnecessary middlemen. Dell Computers and Amazon.com provide good examples of firms that have reduced inefficiencies in supply and distribution channels. A cost leader must provide equal product qualities when compared to differentiators. In addition, there is usually only room for one cost leader within a broadly targeted segment.

Much of the construction industry is being forced into this quadrant through owners' positioning of low-bid procurement strategies. The highly competitive industry responds fervently, but few competitors are able to come out as consistent cost leaders. Profit margins are too slim to support a firm leader. Architect/Engineering firms are also sliding to this sector with more commodity-oriented work. Quadrant IV projects offer the least opportunity for competitive advantage because innovation is limited and risk allocation is unbalanced as a result of owners' procurement structure. Opening the system to more innovation through performance specifications and integrated delivery methods would allow innovators to gain cost advantage. Promoting a low-bid, segregated procurement strategy does not allow firms to establish competitive advantage. In fact, the nature of competition rewards firms with such low profit margins that they cannot sustain an advantage.

Differentiation

Since it is difficult to be a Cost Leader, firms often seek to provide unique products or services. This entails identifying select needs or wants within an industry and catering specifically to those needs through structure. The premium price associated with differentiation must be greater than the cost of differentiating. Often this requires the firm to be very cost effective in other aspects of their structure that do not help to differentiate. Differentiation Focused firms provide products or services within a narrow segment. For example, a construction firm may choose only to work in exclusive renovation work for private universities.

Owners requiring services of the EPC industry can offer firms innumerous way to differentiate through better delivery and finance methods. For, example, benchmarking and establishment of a DBO competition for the Tolt River Water Treatment Plant in Seattle, Washington, invoked a unique response from the industry. (ISDR 1998) Firms normally focusing on standard, commodity-oriented water treatment plant design, construction, and operations were allowed in incorporate new technologies and operational ideas into a single DBO proposal package. The firm with the most advanced technology implementation, that also uniquely vertically integrated[23] to provide the best overall life cycle package won. The competition resulted in huge savings to the client and a new source of competitive advantage for the producer team. In this case, the best differentiator was also the cost leader. This was due to an innovative advantage in water filtration technology that the competitors did not hold. Generally, advantage from such innovation is not sustainable unless it can be protected from imitators. This dynamic environment will force the firm to innovate further and reduce costs where differentiation is not affected.

Establishing generic strategies allows firms to focus on fundamental issues in establishing competitive advantage. This should not entail a laundry list of objectives, but rather a clear articulation of what advantage the firms seek based on a fundamental understanding of industry structure. Other common practices involve focus on market share leadership. This is an effect rather than the source of advantage. Seeking leadership in itself can blind firms from making decisions that sustain competitive advantage. The EPC industry is no stranger to this hollow goal. In an industry where virtually no distinct leaders exist, firm still struggle to increase top line volume.[24] A good example of the dangers in this outlook can be found in the fall of Stone and Webster this year. Their lack of focus on core competencies and pursuit of sheer sales volume led to bankruptcy. Their goal of being a top 25 EPC firm meant trying to attain global volume of sales regardless of the risks at hand. (Stone and Webster 1998)

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[23] See Section 2.3.3.5 for a discussion on Vertical Integration.

[24] Even the Engineering News Record ranks firms by volume of sales without regard for profitability. In the EPC industry where few firms are public, profit measures are not readily accessible.

2.3.3 Competitive Advantage

" Competitive Advantage describes the way a firm can choose and implement a generic strategy to achieve and sustain competitive advantage." (Porter 1985, pg 26) Within a value system, firms' own value chains are constructed of general activities that they can hone to produce competitive advantage. First, a firm must determine the segment or channel within which they wish to compete. This can be made more apparent in illustrating the value system for a particular industry.

2.3.3.1 The Value System

The value system describes the flow of products and services from their sources to the end users through a set of industry value chains. Firms' source of competitive advantage lie in the competitive, geographic or integrated vertical scope they develop within this system. Focusing on specific segments or providing services across numerous value chains each have advantages and downfalls. The value chain illustrated below in Figure 2-15 represents a typical EPC value chain that the Navy engages for facility delivery, and management.

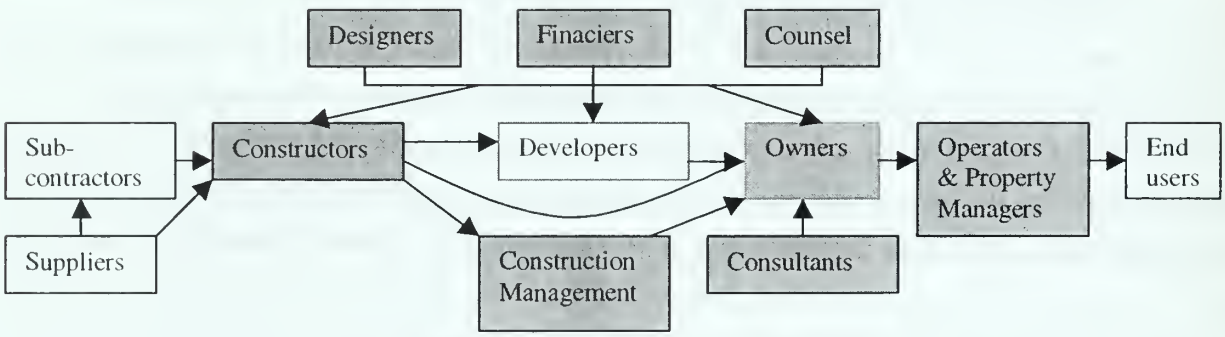

Figure 2-15: Generic Facilities and Engineering Value System

The Naval Facilities Engineering Command's (NAVFAC) role in the EPC value systems is very broad. Grey shading in the value system figure represents NAVFAC's vertical integration throughout. Within these shaded value chains, NAVFAC has applied a tapered integration strategy, performing a baseline level of service and outsourcing the remainder. The degree of taper varies significantly with each chain. For example, almost all construction procurement is out-sourced to the private sector, however, the Naval Construction Force (Seabees) provide contingency construction capacity. To keep their construction skills honed for military mission requirements, the Seabees provide general construction services to bases around the globe. Another example of tapered integration can be found in base housing operations management. Once a wholly internal management function, outsourcing of housing services and ownership is now taking place in selected areas through public private ventures.

2.3.3.2 Industry Segmentation

Since industries are not homogenous, segments exist within them that are affected in distinct ways by the five competitive forces. An industry segmentation analysis can help break down strategic questions like where to compete and what strategies will be sustainable. It is a good basis for focus strategies because it can expose segments that are served poorly by broadly focused providers.

Segments can grow out of differences in buyer behavior and the economics of supplying different products and services. Dissimilarities in supplier, firm, channel and buyer chains can affect the attractiveness of individual segments. These differences also affect the sources for competitive advantage if they:

- Affect drivers of cost or uniqueness in a Firm Value Chain (FVC)
- Change the required configuration of the FVC
- Imply differences in the buyer's value chain (Porter 1985, pg. 236)

However, the largest potential for gaining competitive advantage exists where there are product or service configurations that are feasible yet not yet available. These are the very core ideas behind alternative delivery and finance methods. New ways of viewing segmentation offer great potential in exposing segments that focus on:

- New technologies or design
- Additional functions or enhanced services
- Simplifying functions or their delivery
- Different bundling configurations (Porter 1985, pg. 247)

The main ways to define strategically significant segments is through product variety, buyer type, intermediate (channel) type, and geographic location. A generic segmentation matrix is presented in Figure 2-16 below. Several of these matrices can be merged and refined through eliminating irrelevant segments. Based on this refined presentation of potential segments, "five forces" analysis can assist in identifying those segments that are most attractive.

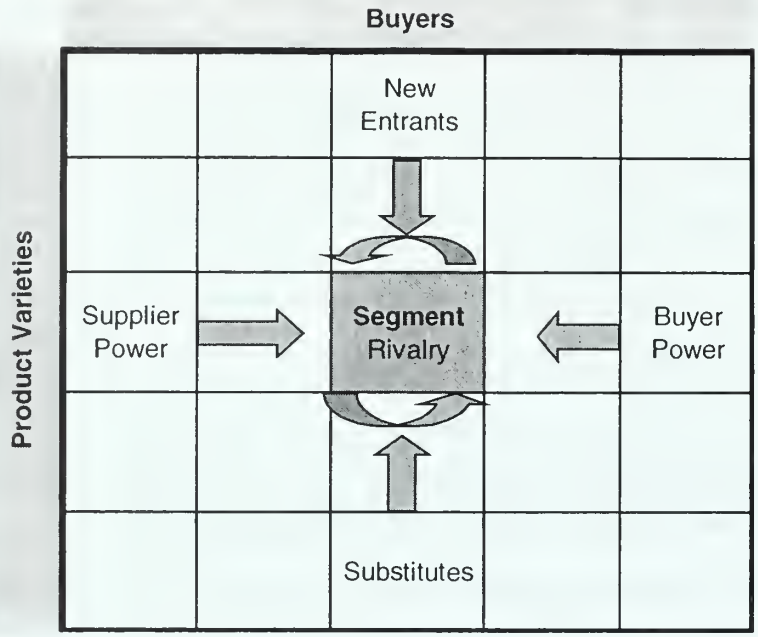

Figure 2-16: Generic Segmentation Matrix with Five Forces Illustration (Porter 1990)

2.3.3.3 Firm Value Chain

Porter's Firm Value Chain (FVC) framework provides a systematic way of looking at all the distinct activities performed by a firm. It breaks these activities into those most relevant in analyzing sources of competitive advantage. The nine generic activities are illustrated below in Figure 2-17. This FVC chain highlights distinct activities used in creating value for clients. The activities can be broken into support and primary functions. Support functions provide general support to the entire firm whereas primary activities relate to specific production, sales and service functions.

Improving linkages, or cost and performance relationships, between activities of the same FVC and integrated FVCs is a major source of competitive advantage. This advantage can be achieved through optimization of the firm's generic strategy. The goal is to create value through linkages and escaping a zero sum paradigm to more synergistic relationships both internally and externally.

NAVFAC Firm Value Chain

Since the Navy represents a governmental agency, it must inherently follow different rules and strategies than the private sector. However, this should not restrict it from applying private sector strategy tools for two reasons. First, this viewpoint will help in understanding industry structure more intimately and assist in structuring more advantageous procurement strategies for both sides. Second, it will assist in molding its own organizational structure and strategy to improve effectiveness. Figure 2-18 below illustrates how NAVFAC's Firm Value Chain might be configured in terms of current primary activities.

Generic Firm Value Chains

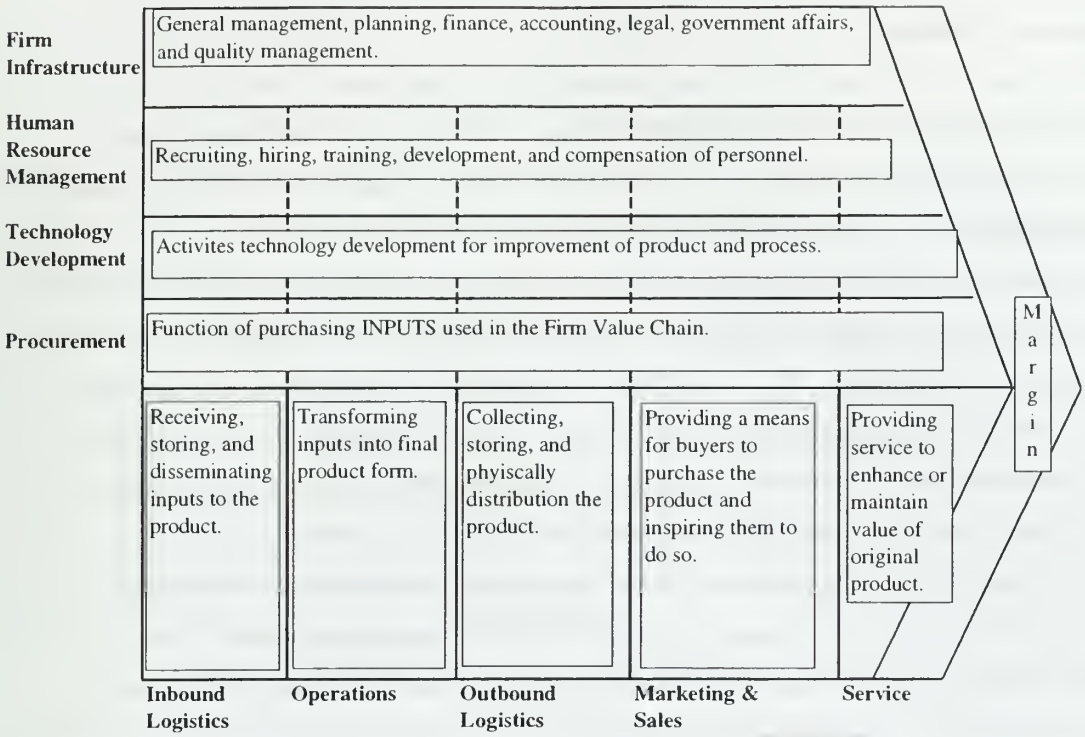
Firm Infrastructure
General management, planning, finance, accounting, legal, government affairs, and quality management.
Human Resource Management
Recruiting, hiring, training, development, and compensation of personnel.
Technology Development
Activites technology development for improvement of product and process.
Procurement
Function of purchasing INPUTS used in the Firm Value Chain.
Receiving, storing, and disseminating inputs to the product.
Transforming inputs into final product form.
Collecting, storing, and phyiscally distribution the product.
Providing a means for buyers to purchase the product and inspiring them to do so.
Providing service to enhance or maintain value of original product.
Margin
Inbound Logistics
Operations
Outbound Logistics
Marketing & Sales
Service

Figure 2-17: Generic Firm Value Chain (Porter 1985)

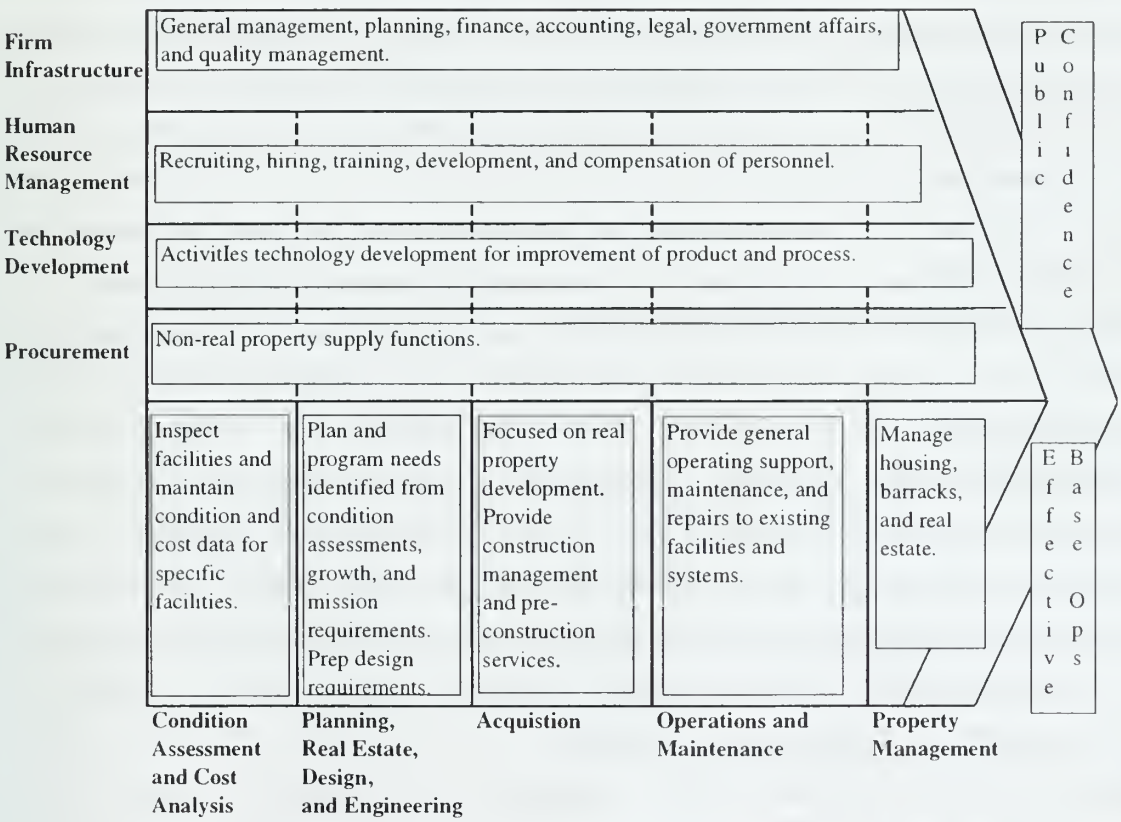
Firm Infrastructure
General management, planning, finance, accounting, legal, government affairs, and quality management.
Human Resource Management
Recruiting, hiring, training, development, and compensation of personnel.
Technology Development
Activities technology development for improvement of product and process.
Procurement
Non-real property supply functions.
Inspect facilities and maintain condition and cost data for specific facilities.
Plan and program needs identified from condition assessments, growth, and mission requirements. Prep design requirements.
Focused on real property development. Provide construction management and pre-construction services.
Provide general operating support, maintenance, and repairs to existing facilities and systems.
Manage housing, barracks, and real estate.
Public Confidence
Effective Base Ops
Condition Assessment and Cost Analysis
Planning, Real Estate, Design, and Engineering
Acquistion
Operations and Maintenance
Property Management

Figure 2-18: Generic Firm Value Chain for NAVFAC Facility Management

2.3.3.4 Fragmented Industry

The Engineering-Procurement-Construction industry is highly fragmented. That is to say, "no one firm has a significant market share and can strongly influence the industry. Usually fragmented industries are populated by a large number of small and medium-sized companies, many of them privately held." (Porter 1980, pg 191)

The construction industry has numerous factors that contribute to its fragmentation that include low barriers to entry, lack of economies of scale (each project has a learning curve), high labor content, and high transportation costs, to name a few. Advantages of running smaller companies in design and construction also contribute to fragmentation. Contributing elements that reward smaller firm structure and therefore fragmentation include low overhead costs, high creative design content, need for close local control presence. Additionally, many designers and builders are simply attracted to the creative atmosphere of their respective trades regardless of profit margins, salary potential or risk structure. A final significant element in industry fragmentation comes from local statutes and regulations. For example, each state has their own building codes, professional registration requirements and contracting regulations.

In fragmented industries, firms cannot readily change industry structure but can consolidate or focus in efforts to overcome the pitfalls of fragmentation. Firms can integrate backwards toward the suppliers or isolate themselves from sources of fragmentation by franchising locally under a regional or national umbrella. Other ways to cope with fragmentation involve specialization in a geographic area, customer type, product or service segment.

Dealing with the issues of fragmentation takes dedicated focus to strategic structure. Firms must be able to turn away business that would divert them from their source of competitive advantage, their generic strategy. In seeking market dominance, they can dangerously expose themselves to unnecessary risk.

2.3.3.5 Vertical Integration

Vertical integration is an important theme in integrated delivery methods. Defined as the combination of distinct chains or processes within a value system, vertical integration represents a decision to engage distinct value chain activities rather than rely on external industry sources. For example, a construction firm may integrate forward to development or operations or integrate backward to design. A DBFO firm may engage almost an entire value system. This could be done internally, but is more likely to be achieved through a consortium of specialists.

Balancing the risks of focusing and vertically integrating, firms must take into account many structural issues beyond immediately obvious financial outcomes. Each decision must be weighed

carefully in light of the current market state and structure. Some of the benefits include economies of integration (scale), dependable supply or demand, ability to differentiate, elevated barriers to entry and entry into higher return chains within the value system.

The nature of economies of integration within infrastructure delivery and finance offer the greatest impact. Economies of combined operations can lead to a life cycle focus in all value chains, saving cost and time over the long term. This is aided by the improvement in internal communications, control and coordination. Design, construction, material delivery and operations issues can be more closely interwoven, eliminating transaction costs and wasted resources sitting idle in cyclic "down" times prevalent in segregated delivery. Additionally, upstream and downstream value chains become familiar with specification, constructability, operational, and finance preferences and needs thereby reducing learning curve or relationship-building inefficiencies. Backward integration can also provide technical or intellectual property advantages. For example, use of a new water filtration medium provides advantage that is seated in access to advanced technologically, enabled by design and construction, and sustained through efficient life time operations. (ISDR 1998)

Also close to the critical issues in integrated infrastructure delivery are the ability to differentiate, elevate entry barriers and enter value chains offering higher profit margins. A DBO entity can offer differentiated services where solicitations reward innovative design, financial engineering and operational management. Expanding vertically from construction, where profit margins are suppressed, into chains of development, real estate, and finance may provide opportunity to capture higher margins. Raising barriers to entry by vertically integrating across distinct value chains may be an effective strategy in the highly fragmented EPC markets. All of these strategies require significant risk analysis, allocation and management in order to balance integration of unique businesses.

Several hazards must be strongly considered before considering a vertically integrated strategy. Strong market position in one field does not necessarily translate into others. Only if the integration of design and construction actually produces faster delivery and lower costs enough to allow competitive advantage in a different market segment will this apply. It is not always cheaper to do things internally because specialists are more acutely aware of their costs than generalists. Additionally, vertically integrated firms often have higher fixed costs, higher capital requirements and are more leveraged. This higher operating leveraging increases exposure risk to fluctuation in any one of the integrated chains. This is particularly applicable in the cyclical nature of construction, real estate and finance value chains. Also, cost advantage can be lost with the absence of outside competition. Lastly, management and corporate culture issues vary widely among the value chains within a system. A challenging construction site with numerous concurrent trade activities requires significantly different management and skill sets than those required in property management or real estate firms within the same value system..

2.3.4 Competitive Advantage of Nations

Sustained prosperity is the product of a nation's choice to commit to developing an environment rooted in vigorous competition that supports continual forward movement. Success, in Porter's view, is equated to wealth and is a result of high and rising productivity.[25] Nations choose their route to prosperity via establishment of competitive climate, laws, policy and institutions that focus on productivity. Firms are encouraged to upgrade and progress if their home nation assists in upgrading the capabilities of its people and invests in specialized infrastructure that enables efficient commerce. Porter models the determinants that enable or disable effective and efficient industry productivity in a "diamond' which is acted upon externally by chance and government forces. Figure 2-19 illustrates Porter's "diamond.

Government forces are not directly interactive as a determinant, but as an influence upon all determinants in industry diamonds. At all levels (federal, state and local), government must play a tapered role in promoting productivity. Its most important roles are indirect and relate to establishing an environment that promotes vigorous competition. While it should establish rigid standards for safety, health and the environment, it should not be compelled to dictate how products and services are delivered beyond these foundations. Much of industry competitive advantage lies outside firms themselves in the determinants of the diamond supporting their value systems. Both the government and the private sector have significant and collective roles to play in investment within these determinants.

The "diamond" is a system based on competition that is dynamic and evolving. This dynamism is fuel at all levels from government down to individuals. The model proposes that firms within nations can only perpetual improve or decline because there is no equilibrium point where they can rest comfortably. This upward or downward spiral is nurtured in highly localized home base clusters where jobs, technologies and advanced skills are continually being pushed to a higher order. Here the competitive process produces winners from segmented markets, differentiated products and services, technology innovation, and economies of scale. Government can play a significant role pushing industry advancement in lieu of finding ways to assist that can discourage firms from finding their own source of competitive advantage. To succeed, leaders must be able to create different jobs in new segments instead of just new jobs. They must embrace change as an essential element of sustained competitive advantage.

2.3.4.1 Determinants of Productivity: Forces of the Diamond

It must be made clear that firms, not nations, compete and therefore create competitive advantage. They compete in industries, or groups of competitors providing products or services that compete directly with one another. The nature of competition varies significantly among distinct industries. Firms gain

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[25] The discussion in Section 2.3.4 is based on readings from Porter's book, Competitive Advantage of Nations.

advantage when their home base encourages dynamic competition in an open system that catalyzes continually improvement of competitive advantages. The diamond system illustrated below in Figure 2-19 illustrates the determinants and outside forces that interplay dynamically to elicit success or failure of a firm, industry, or clusters of industry. This model can be used at any level of firm or industry to explain the dynamism that creates or degrades competitive advantage.

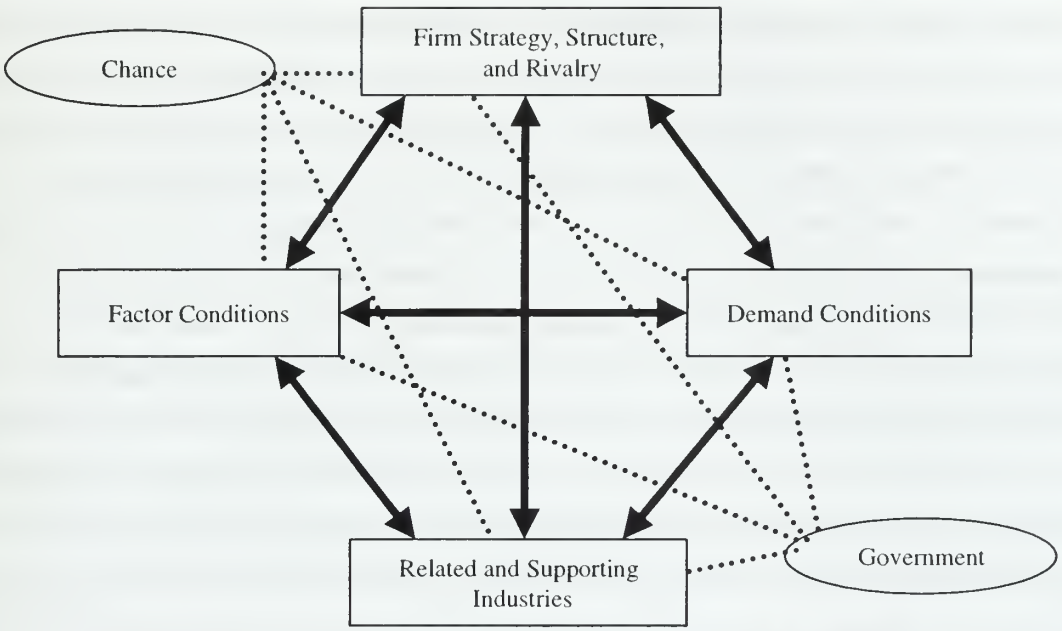

Figure 2-19: The Diamond System of National Advantage (Porter 1990)

Factor Conditions

Factors of production, or factor conditions, are the building blocks for competition within an industry. They include groups such as human resources, physical resources, knowledge resources, capital resources and infrastructure. Infrastructure systems, for example, include networks in transportation, information, logistics, electronic funds transfer systems, health care and items that affect the quality of life. Housing and cultural treasures or institutions are also factor conditions and play a large role in establishing the attractiveness of a nation in terms of quality of life.

Basic factors such as raw materials and unskilled labor no longer provide a sustainable source of competitive advantage, however, advanced factors such as fiber optic communications networks and highly educated personnel are key to advantage. Governments are notoriously slow in providing advanced and specialized factors unless closely tied to industry. Therefore advanced, or higher order factors, must be created within a nation through closely supportive interplay between industry, government and academic institutions. For example, establishment of consortiums between government, industry and academia to further applied research, develop robust standards and translate new ideas and technology into practice is an investment in factor creation. Without advanced factor conditions,

innovation and continually improvement will stagnate. Sometimes selective disadvantages, like oil crises or harsh climates, will serve to stimulate innovation that can translate into national advantage.

Infrastructure is an integral element of the "diamond" system as a key *factor condition* that allows other industries to thrive. Infrastructure, in itself, represents an industry that interfaces all determinants. It is assumed to be in place to enable the dynamism required to catalyze innovation. Rough diamonds are honed in nations that have established such infrastructure and enabled vigorous competition. The extent to which infrastructure systems upgrade in the future depends much upon de-fragmentation of the industry and government's role in implementing the Fundamental Elements as described by J.B. Miller. Individuals, firms and government all play key roles in the innovative interplay of clearly defined competition enticed by transparent government processes and strong signaling.

Demand Conditions

Home demand for an industry's products and services dynamically influences the other determinants. The composition and quality of the demand will determine how the industry responds. Segmented demand creates new opportunities for firms to upgrade their positions, particularly where the emerging demand segments are sophisticated and large. Sophisticated clients, or end users, can provide strong pressure to meet increasing standards and need for innovation. Anticipating buyer needs can be a significant advantage, particularly in American culture where improved convenience in any form is in high demand.

Early home demand and saturation have played a role in strengthening American production, construction and engineering industries. The huge demand from the Department of Defense provides a large market that often rewards innovation. This demand creates significant advantage to firms where military applications translate directly to the civilian sector. This has proven true for aircraft like the Boeing 747, and the same can be true for housing and the military construction provided the right commitment and incentive for innovation exist. Also, American's rise to engineering and construction dominance after World War II shows how early saturation can provide sustained advantage. Obviously special circumstances where a large imbalance in skills and capacity exist are required. However, finding segments with unmatched needs is a basic source of competitive advantage at all levels.

Related and Supporting Industries

Supplier and related industries support industry advancement if they can quickly provide firms with information, ideas and superior components or services. Close working relationships or even vertical integration with suppliers and related providers can also provide more direct communication of producer needs. Conversely, firms can serve as test beds for new products and services. Providers increase pressure for innovation and continual upgrades within clusters as they disperse new information

and technology. The EPC industry's foundation lies in a broad spectrum of related and supporting providers.

Firm Strategy, Structure and Rivalry

Strategy, structure and rivalry are the most influential elements upon the "diamond's" other determinants. Differences in structure and fierce competition are at the heart of competitive advantage. Industries will thrive where management practices and allowable firm structures are aligned with source of advantage. For the EPC industry, public infrastructure work is generally restricted to segregated delivery and direct finance methods. This misalignment between private and public practice does not encourage firms to structure themselves for integrated service delivery. The opposite is true for deregulated communications and power industries.

Company goals are heavily influenced by ownership structure. The EPC industry does not closely reflect the influences of public capital markets because most firms are not publicly held. Those that are publicly owned are having significant difficulty maintaining solvency in this time of prosperity. Private owners often have a more long-term outlook than officers of publicly held corporations and are more committed to their specific industries.

Individual goals and development play a large role in firm structure. It is essential that leaders within companies establish corporate cultures that foster creativity and provide motivating incentives. This will aid in establishing a mutual long-term growth outlook for both individual careers and the corporation. Those firms investing intelligently can promote retention of highly trained employees by providing an innovative environment. Firms can also foster competitive advantage by establishing relationships with universities as a source of training, innovation and interchange. This is difficult in the insular, segmented infrastructure industry, especially where advanced degrees are not a standard. Government agencies provide a stable, comfortable environment that offer a long-term employee outlook, however, incentives for innovation or improvement are rare. Government should be stable, however, if any efficiencies are to be achieved, some private practices must be infused.

National prestige also plays a role in goal setting, goal attainment and rivalry. A nation's success depends upon its talent pool. Training young people in science and engineering invests in the economy as this provides the foundation for innovation. National passions for specific callings can heavily influence which industries will thrive. In the U. S., the allure of entertainment, finance, and sports draws throngs of new talent that sustains the industries. At another level, professional calling for advanced degrees and ever-expanding opportunities in medicine, law and business is accelerating those professions. Engineering is still searching for parallel appeal, draw to higher education and avenues for civic impact within a modern national outlook.

The strongest source of competitive advantage may be industry rivalry. Domestic rivalry spurs firms to innovate and upgrade. The current pace of the economy in some sectors leaves most firms in fear of being left behind if they do not innovate. The number of firms and their diversity are necessary elements in establishing innovation and in growing new firms. This environment promotes testing of new and expanding configurations leaving only the strongest to survive in a Darwinian process.

Firms are the engine of the "diamond." They grow where there is clear incentive to gain and sustain competitive advantage. Those that forge into the toughest markets will continually improve and thwart complacency. This forces investment in upgrading factor conditions, re-organization of structure, and influences supporting industries to upgrade. Companies sustain advantage by moving early or making their own processes and technology obsolete. This agility and motivation makes firms, not governments, the most effective means of providing infrastructure and related services. Infrastructure related firms that are stagnant in their respective segments, will fail to succeed where increasingly sophisticated demand requires integrated, multi-disciplinary solutions.

Role of Chance

Chance plays a role in the development of competitive advantage by offering opportunities for structural industry changes. The influences of chance upon firms include inventions or major technical advances like the computer, car, airplane, or categorization of the human genome, political events and war. Invention and entrepreneurship fall within the realm of chance, but their occurrence is not purely speculative. Providing an environment that allows creative forces to work within a fiercely competitive environment often spurs innovation. For example, cluster dynamism has proven to enable continual biotechnical innovation in Boston, Massachusetts. As chance provided the U. S. EPC industry a boost in the wake of World War II, it is interesting to note the long-term effect of the same hardship on defeated nations. Germany, Japan, and Italy's downfall has since provided the environment and incentive to develop sustainable competitive advantage in international commerce.

Role of Leaders and Individuals

The most significant role played by individuals within industry is in leadership. "Leaders believe in change." (Porter 1990) They force training, education and strengthening of high-order factor conditions that enhance competitive advantage. Leaders overcome limits to information and innovation. They have a broad, non-insular view of their companies in relation to regional and international competitive advantage and work upwards to influence legislation that promotes sustained competitive advantage. This lonely position of forcing painful issues goes against the human and company norm of seeking comfort and stability. Infrastructure's fragmented nature poses difficult challenges for modern leaders to bridge the barriers that prevent whetting the diamond.

Individuals also play roles in each determinant outside of core leadership roles. Their education levels, labor skills, family values, group behavior, attitude toward management, and social values play a large role in the dynamism between factor and demand conditions. Individual sophistication in these determinants increases pressure for improvement. Entrepreneurs and small partners form a large part of the fragmented infrastructure industry fueling rivalry into unhealthy dimensions. Normally, fierce competition would benefit an industry, but the EPC markets' structural flaws prevent gains in market share and suppress margins.

Clusters

A productive economy requires specialization in focused industry segments. These segments are supported most readily in "clusters" where groups of interconnected firms, suppliers and related industries are present in a geographic region. Clustering reduces transaction costs and improves efficiency, but more importantly, spurs innovation and speed of growth. Silicon Valley in California is a superb example of how a bustling computer industry cluster has bolstered worldwide dominance for the U. S. in this field. Internal industry diversification strengthens all determinants, especially in cluster areas. Numerous examples are available through Europe where world-renowned products or services hail from specific cluster areas within regions and cities. Such cluster areas apply mainly to commodity markets and are not as prominent in the fragmented, infrastructure markets. Although some clustering effects still remain for design firms, this dynamism is fleeting as design becomes more commoditized.

2.3.4.2 The Role of Government in Enabling Competitive Advantage

Government plays a prominent role in forming national competitive advantage. This role should mainly be indirect because government cannot directly control firms effectively. Focus should center on enhancing dynamism within industry diamonds that leads to high and rising productivity and thereby improves quality of life for its citizens. Slow and indirect pressure should be applied to enable sustainable competitive advantage instead of short-term gains. The following paragraphs illustrate how governments can best influence the determinants to promote opportunity for national competitive advantage. Broadly, this action sums to 1) providing incentive and opportunity instead of assistance, and 2) avoiding protective policies that thwart healthy competition.

Factor Creation

Nations and industries can only upgrade commensurate with their available talent pool. Investment in higher order factor conditions is one of the most influential ways government can promote prosperity. Factor creation is most effective if national respect and understanding of prosperity centers on training, research, education, and infrastructure. Government investment should be directed to generalized areas and levels upon which the private sector can build specialized factor conditions.

Education and training is a great area for long-term investment and offers influential leverage on the diamond in numerous ways. Government should establish high educational standards at the national level because locally established standards lead to uneven education levels. Also, too often, such standards are geared toward the lowest common denominator. By catering to the lower end of the performance spectrum, the best and brightest are stifled.[26] For example, the Defense Acquisition Workforce Improvement Act has established standards for government procurement, but the current mandatory training program caters to basal aptitudes. The program does provide a basic foundation for acquisition personnel, but it fails to develop higher order factors and thus perpetuates the governments' inefficient performance. It also fails to challenge its highly qualified personnel and attract new, energetic talent.

The national outlook on education should also serve to inspire excellence in other than university education. Most people do not need college education to be successful within the workforce. Instead, highly specialized and prestigious technical institutes should be further developed and promoted to upgrade the standards for the nation's labor force. This focus would align education more synergistically with industry structure.

Most competitive nations encourage research. This may be better served by focusing simply on innovation instead of just science and technology. Additionally, research needs to be more directly tied to industry. Emphasis on university relationships instead of government laboratories can provide a better base for innovation where new ideas and greater diversity are prevalent and perennial. Firms themselves should initiate research efforts as a source of competitive advantage. Too often in the current economy, firms are cutting research efforts as a short term means of increasing profit margins.

Capital is critical to any firm's success. Government should focus on allocating funding toward investments in productivity. Investing in infrastructure and other factor upgrades is one the most direct means of influencing productivity. Unfortunately, direct support will never cover all current or growing needs, so these efforts must be structured in tandem with private investment. Subsidy, on the other hand, is rarely a source of advantage. It prevents firms from investing in their own advancement and causes them to rely unduly on the government. Indirect subsidy through research, education, and infrastructure offers basic factor conditions that can promote upward spiraling in any industry diamond.

Infrastructure in itself cannot support competitive advantage, but its absence can prevent development. Industry advancement requires a high and rising infrastructure growth. Its renewal, growth and sustainability are a mutual responsibility to be shared by private and public sectors.

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[26] General Collin Powell's Lesson Number Eight from "A Leadership Primer."

Government's Effect on Demand Conditions

Government policies should be more concerned with the quality rather than quantity domestic demand. By focusing on increasing the standards or quality of demand rather than the amount of budget allocated or cost of capital, private response will better serve productivity gains. As a principal buyer in defense and infrastructure related industries, government has significant influence on industry structure.

The government can positively influence competitive advantage by being a demanding and exacting consumer. First, setting early demand for advanced products and services can propel industry to innovate. Establishing exacting performance standards and encouraging diversity will motivate upgrades in industry processes. On the other hand, insular policies such as the Buy American Act prevent outside competition thereby allowing domestic firms to become complacent and dependent upon protective policies. Other important upgrades through standards are rooted in stringent regulations for safety and environmental impact. These long-term policies promote both industry and quality of life sustainability. Lastly, a recurring theme to increasing productivity lies in establishing fierce competition through processes that enable innovation.

Defense procurement can have a synergistic effect upon national productivity if aligned well with civilian industry markets. Often the defense markets offer early, sophisticated demand but without civilian application. Firms structured to succeed by responding only to this demand are subject to defense spending cycles and are often poorly suited for commercial market competition. Infrastructure provides immense opportunity for development and transfer of industry competitive advantage between defense and civilian sectors. Government should seek every opportunity to demand early and sophisticated services in this sector where unbounded potential for upgrade exists.

Supporting Industries

Regional economic policies established at a national level are rarely effective. Since regional economics vary greatly within nations, it is best to allow local authorities determine what best promote regional productivity. This delegation will allow the advantages of local conditions and industry climate to be nurtured. Shaping policy and competition to optimize local conditions will foster clustering effects from synergy between private and public sectors. As long as the regional authorities are empowered to promote best practices locally, this structure will maximize regionally advancement while supporting and national competitive advantage.

Government's Effect on Firm Strategy, Structure, and Rivalry

Government should play an active, yet indirect role in effecting strategy, structure and firm rivalry. Its most influential impacts are enacted through anti-trust law, tax structure and policy on regulation of competition. Strong anti-trust policy serves to spur vigorous competition where horizontal mergers threaten to eliminate rivals and raise short-term returns. While horizontal merger policy should

be stringent, vertical integration should be encouraged in support of innovation. Next, tax policies should be structured at the individual and firm level in ways to reward productivity and high and sustained capital investment. Finally, competition should be minimally regulated. Deregulation and privatization has shown to promote innovation and national competitive advantage. While strong competition will spur new business development, government should also attempt to streamline regulations in new firms' favor.

Summary

Government efforts should focus on sustaining long-term productivity through a tapered approach of direct and indirect influence. Government should play a direct role in basic factor creation and investment. Industry should play an increasingly greater role as higher order factors and investments are required. As nations progress and move toward innovation-based progress, governments' role should shift to that of a facilitator while providing pressure to upgrade. Government must become a sophisticated buyer and be willing to allow industry to advance in a competitive atmosphere.

The "diamond" system focuses on incremental honing that spans decades. This rarely coincides with short-term political or economic agendas. It is difficult to engrain infrastructure life-cycle concepts into operators and officials that thrive on the urgency of daily events. Governments' role should be to indirectly influence vice control determinants within the diamond. As stewards of the majority of infrastructure, government needs to effect planning and procurement at the lowest, most effective levels in order to enhance competition and enable synergistic use of both private and public capital. They must identify projects that can be supported by private means, and tailor portfolio execution accordingly. Where efficiencies are leveraged from private interface, government should redirect existing, stagnant human and capital resources toward the backlog created by a creeping pace. Public efforts should be focused on front-end condition assessment, planning, programming, and requirements development that push more projects to the private sector in order to leverage the largest gross national product in the world.

Porter's diamond provides a effective tool through which infrastructure development can be analyzed. There are, however, a few areas that may taint the lens of this framework in the case of infrastructure. This system assumes that firm wealth through productivity is the most desirable end-state. While this is surely desirable, it presents numerous ideological challenges in the context of public interface. Next, the diamond looks mainly at commodity/manufacturing industries that often vary significantly from the complex, system factors involved in the nature of infrastructure. Such systems are difficult to view in "clusters" their foundational and fragmented nature. Finally, the fact that infrastructure is deeply entwined in rigid governmental procedure and risk averse stewardship makes it difficult to open to the most efficient industry forces. These issues may make focus on Porter's principles even more important. Infrastructure is currently left to decay under stagnant government regulation,

waning funding, and uninterested private firms. It is governments' role to put in motion the Fundamental Elements so the infrastructure industry can restructure and innovate accordingly as it rises to a new realm of competitive challenges.

3 Military Approach to Housing Delivery

3.1 Choice of Delivery Methods

3.1.1 History

As discussed in Chapter 2, the choice of delivery methods has been severely limited within Department of Defense agencies for the past fifty years. In fact, choice is not part of the process because, the Design Bid Build method is predetermined unless unusual opportunities present themselves. Instead of keeping options open to flexible delivery methods, regulation development has focused on trying to "perfect" as singular system. This has resulted in a reliable, transparent method that both the public and private personnel can understand. However, it has not served to advance the EPC industry, lower government life-cycle costs, or encourage innovation.

3.1.2 Federal Acquisition Regulations (FAR)

Federal project delivery methods are generally governed by the Federal Acquisition Regulations (FAR) which are published by the Office of Federal Procurement within the Office of Management and Budget. Currently, the FAR and Defense Federal Acquisition Regulations (DFAR), the DOD's tailored version, limit construction services to Design Bid Build (DBB) and very limited form of Design Build (DB). The authorization for rigid, two-step DB Services is a recent modification to the FAR (Jan 1997)[27].

As discussed in Professor Miller's segmentation model, the DBB and restricted DB methods leave the DOD and Navy isolated from methods offering improved technical and financial performance. However, recent legislation allowing the Armed Services to pursue alternative delivery and finance methods are veering contractual structure away from the FAR's rigidity with the exception of basic wage and discrimination issue clauses. Although limited under specific laws and heavy Congressional control for a limited time span, the DOD is being allowed to explore "new' contracting methods.

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[27] FAR Part 36.3 describes the criteria for using DB and the subsequent two-step selection process. In this form of DB, "The scope of work may include criteria and preliminary design, budget parameters, and schedule or delivery requirements." Generally, the DOD has commenced the DB process after development of a significant conceptual design, which eliminates significant innovation potential from the system.

3.2 Legislative Direction

3.2.1 Testimony of Agency Secretaries

3.2.1.1 Department of Defense

The Deputy Under Secretary of Defense (DUSD) for Installations, Randal Yim, testified before the House of Representatives Military Installations and Facilities Subcommittee in March of 1999 concerning several recent initiatives. He described a multi-part strategy to improve installations by aligning base structures to match changing mission requirements. At the top of his list was military housing improvements. As cited in Chapter 1, two thirds of the DOD's 300,000 houses are in need of extensive renovation or replacement. He states that, through implementation of the Military Housing Privatization Initiative[28] (MHPI), the DOD plans to meet its goal of replacing or renovating its poor stock by 2010. MHPI was enacted in 1996 by Congress to provide the DOD new authorities to use private sector expertise and capital to accelerate improvement of government-owned housing. Within MHPI, a Family Housing Improvement Fund (FHIF) was established to handled "privatization" funding for housing construction. Initial "privatization" efforts encompass 16,000 houses with up-front funding cost of $236 million. (Yim 1999) This is a reduction from standard Military Construction estimate for the same projects of $1.3 billion.

Testifying again in March of 2000, Mr. Yim, restated the importance of the housing initiative for Quality of Life support. He introduced new funding initiative, updated goals, reported current progress, and stated lesson learned. First, the Secretary of established and funded a housing improvement initiative including:

- Increasing housing allowances to eliminate out of pocket costs paid by Service Members for private sector housing.
- Increasing reliance on the private sector through "privatization"
- Maintaining the current pace of military construction funding. (Yim 2000)

This effort will increase housing allowance by over $3.0 billion over the next five years and will serve to reduce dependence on base housing, increase viability of PPV efforts, and enable more efficient use of military construction funding. Mr. Yim reaffirmed the DOD goal of eliminating inadequate base housing by 2010 and barracks by 2008. Next he offered a progress report in which he reviewed initial efforts and current solicitations. Leverage of DOD to private sector funding ranged from 4:1 up to 23:1. Lastly he explained the pros and cons of the twelve basic authorities established by MHPI. Four of the twelve authorities proved to be both useful in implementing

[28] Section 2885, Title 10, United Stated Code, established the Military Housing Privatization Initiative.

solicitations and reducing budget requirements. These included Direct Loans, Joint Venture Investments, Differential Lease Payments and Conveyed Units/Property.

Additional lessons cited recent confirmed life cycle savings, and the importance of long-term ground leases and contract terms. For example, a recent GAO report estimated life cycle savings of 11% on these projects. Initial Air Force and Army contracts involving 50-year terms, resulted in more innovative solutions, enhance quality and reduced risk of project failure.

Mr. Yim concluded with several uplifting notes. First, he acknowledged need for a more unified approach to housing delivery across all Service Branches. Next, he stated that the DOD has begun to integrate Military Construction and "privatization," programs with housing allowance and requirements programs. Finally, he requested a five-year extension to the Military Housing Privatization Initiative which expires 01 February 2001.

3.2.1.2 Department of the Navy

Following the DUSD's address, Duncan Holaday, the Deputy Assistant Secretary of the Navy (DASN) for Installations and Facilities, expressed the Navy's efforts in using PPV as a tool for delivering better and faster housing projects. He summarized the following objectives for his new PPV Policy addressing future roles of traditional Military Construction, Construction Standards, and occupant out-of -pocket expenses:

- Consider PPV first. Where communities cannot meet our housing needs, we will rely first on PPVs, including replacement construction and whole-house revitalization.
- Regional Scope. We will evaluate our housing needs on a regional basis.
- Quality Standards. We will establish PPV housing quality standards comparable to what the private sector provides for civilians in similar income scales.
- Out of pocket expenses. Our goal is no out-of-pocket expenses for members.
- Rent scale. Rent scales are based on unit size and quality.
- Conveying land or units. We will NOT convey land unless it is excess to our long-term needs.
- Allowing non-military occupants. Service members will have preference. To ensure full occupancy, PPVs can accommodate civilian leases of limited duration. (Holaday 1999)

Based on these goals, the Navy and Marine Corps are using two Business Models in their PPV efforts: 1) Limited Liability Partnerships (LLPs) for short term (10-15 year) agreements whereby the Navy can provide cash investment of up to 33% of the development cost for housing built on private land, and 2) Limited Liability Corporations (LLCs) for long-tem agreements (50-year) in which the Navy can contribute up to 45% of the development value to include facilities and land in addition to cash.

Following up on these initial goals in March of 2000, Mr. Holaday reaffirmed his commitment to achieving the 2010 goals set by the DOD. The Navy is proceeding with five Navy Projects with $89 million in retained "seed" money and four Marine Corps projects with $39 million in "seed" money. In

addition to the current pilot projects in progress, the Navy will provide Family Housing Master Plans to Congress in July 2000. These plans will outline how each specific base will attain an adequate level of housing by the year 2010.

3.2.2 State and Local Options

The recent Armed Service integrated housing delivery efforts are in concert with new trends throughout the public sector to authorize and engage new delivery methods. The American Bar Association (ABA), in particular, has been proactive in bringing new delivery method tools to state and local governments. In July 2000, the ABA adopted a new Model Procurement Cost which authorizes an array of delivery methods to include Design Bid Build, Operations and Maintenance, Design Build, Design Build Operate Maintain, and Design build Finance Operate Maintain.[29] A similar "tool box" should be adopted by the Federal Government and its agencies.

3.3 Office of Management and Budget (OMB) Issues

3.3.1 Federal Budget

The Office of Management and Budget (OMB) coordinates all budgeting processes for the Executive Branch agencies. They act as the referee for agencies proposing and executing budgets. For the year 2000, the President's Budget proposal was $1.76 trillion of which 15%, or $262 billion, (as illustrated in Figure 3-1) was identified for the DOD.

[29] American Bar Association's Section of Public Contract Law, The 2000 ABA Model Procurement Code, adopted July 11, 2000 by the ABA House of Delegates.

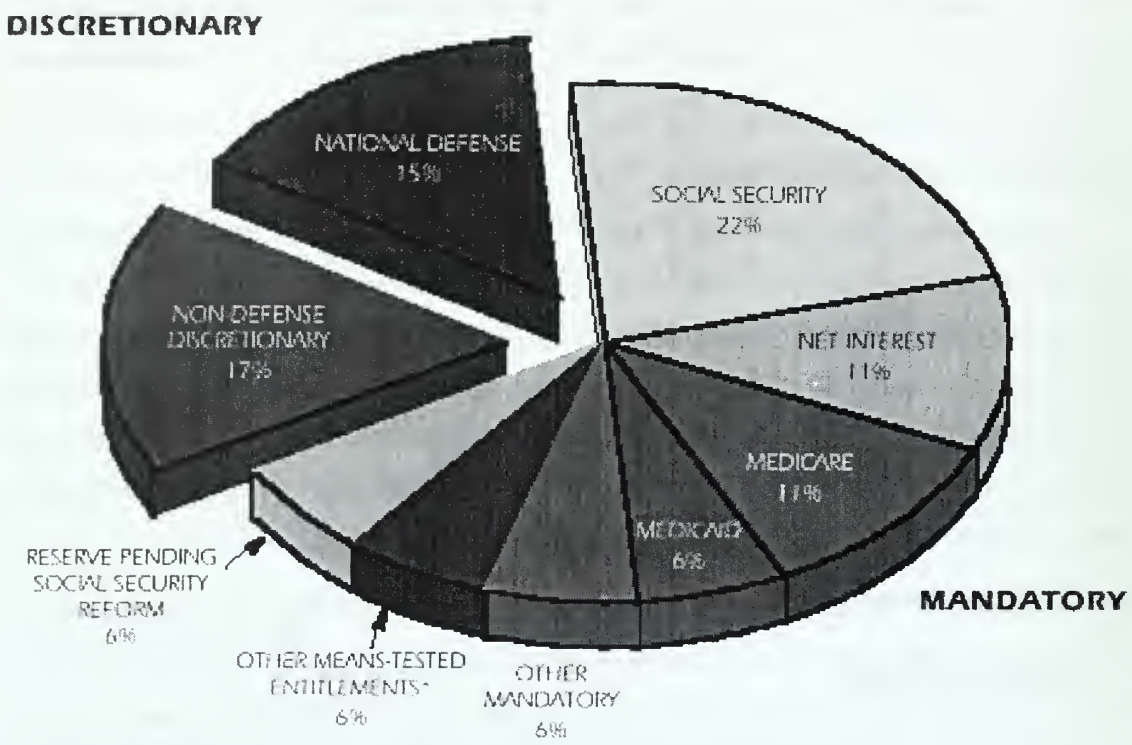

Figure 3-1: Division of the Federal Government Budget (Executive Branch 2000)

3.3.2 Scoring

Scoring measures the impact of a project transaction on the federal budget. Under the Military Housing Privatization Initiative, the DOD must be "scored" on the cost of assistance they provide in alternative deliveries through cash, loans, and other forms of assistance. The "total score" represents the amount of funding the government must obligate for a specific project. Scoring is only assigned to the cash value of the investments, since conveyance of land and housing does not directly impact the budget. The DOD may offer Rental and Occupancy Guarantees, however, these must be scored up-front at the net present value (NPV) of the entire commitment. This has prevented the Navy from using these forms of assistance as they greatly impact the current year budget. Differential Lease Payments that cover the difference between members' allowance and set rental rates are also score up-front at NPV, however these have been necessary to make most contracts viable. Leases must also be scored up-front at the NPV for the entire commitment. Generally, this high-impact has prevented their use. The DOD is currently proposing a series of amendments to the scoring procedures that would improve the feasibility of long-term agreements for housing.

Scoring on MHPI projects occurs in four stages: apportionment, site determination, RFP issuance, and contract award. Apportionment sets an initial financial goal and is based on a preliminary estimate for required outlays. Site determination provides feasibility analysis and ensures the project cost estimate is within the apportioned amount. Prior to issuing an RFP, the OMB reviews DOD scorings and estimates for government equity, differential lease payments and discount rates. Finally, at award, the financial structure and actual budget authority obligations are reviewed in terms of percentage of government participation, risk, and total obligations. (NAVFAC 1999b)

3.4 DOD Budget and Funding

Obligations for Family Housing remain strong as Defense leadership remains committed to Quality of Life issues focusing on housing and medical care. The majority of Naval Facilities funding is channeled into three programs: O & M, housing, and Military Construction. As evident in Figure 3-2, obligations toward Family Housing Construction and O & M remain very strong in comparison to more mission-oriented Military Construction and O & M. This strong position will likely remain through the year 2010 in with DOD Quality of Life goals.

DOD and Navy Obligations

	1998	1999	2000	2001
DOD, Overall	272,370	276,282	281,588	301,321
Navy, O & M	25,990	25,575	25,950	26,104
DOD, MILCON	3,113	2,963	2,705	3,599
Navy, MILCON	962	848	706	1391
Navy, Family Housing, Construction	250	404	275	276
Navy, Family Housing, Total	1238	1348	1191	1179

Figure 3-2: Comparison of Defense Obligations in the President's Budget [30]

3.4.1 Family Housing Budget

The Navy's funding profile for annual housing expenditures is hovering around $1 billion. Operations and Maintenance represents the majority of funding followed by construction and then leasing costs. In 1996, upon passing of the Military Housing Privatization Initiative, housing capital funding was put on hold pending Public Private Venture (PPV) regional studies. The effect of this turning point in housing delivery is shown on the Figure 3-3as a decrease from 1996 to present day. The majority of PPV projects will be awarded this year. Beyond the recent dip in construction or "PPV stall," the Navy's Family Housing Baseline Assessment Memorandum projects a stable increase in funding from $975 million in year 2000 to $1,120 million in 2007. (Shelton 2000)

[30] The Budget for Fiscal Year 2000 from w3.access.gpo.gov/usbudget/fy2000.

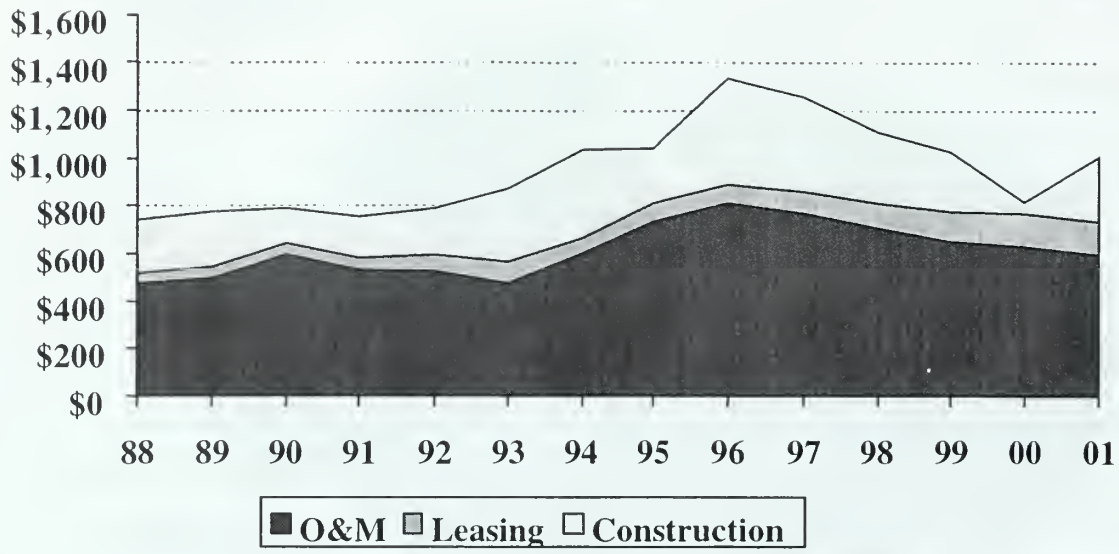

Figure 3-3: Navy Family Housing Funding Profile (Tull 1999)

3.4.2 Military Construction (MILCON)

Military Construction (MILCON) is the term used for new construction valued at over $500,000. Projects above this threshold must be authorized by Congress. Until recently this process took up to seven years. Due to recent restructuring of the design and estimating requirements, the Navy has been able to reduce this cycle to three years. Since this program is has limited funding allocation and is relatively unresponsive, it has forced NAVFAC personnel to focus on repair efforts of existing facilities.

3.4.3 Operations and Maintenance, Navy (OMN)

However, a dearth of O & M funding also presents significant challenges. Bases continue to see their operating budgets decline as they attempt to maintain an unwieldy infrastructure with average building ages approaching 40 years. Current OMN funding represents approximately 1% of the Navy infrastructure's Current Plant Value. (Moore 1997) This is well below healthy private industry O & M figures often ranging from 5-10% of plant value.

OMN is an annual appropriation from Congress that provides for the operational and facilities funding of Navy installations. Currently, the major claimants (warfare or functional commanders) distribute such funding via regional commanders. For example, Commander, Atlantic Fleet will compete his "piece of the pie" amongst Mid-Atlantic, Northeast and Southeast Naval Regions. See Figure 3-4 below for a map of Navy regions. Money to operate the bases and maintain the facilities is given to the base annually to be used as budgeted. Special Projects, which consist of major repair and minor construction projects, are also funded with OMN. These are competed on the region level on a Readiness

Erosion Deterrent (RED) List according to weighted, subjective criteria such as mission, quality of life, safety, and Admiral[31] interest.

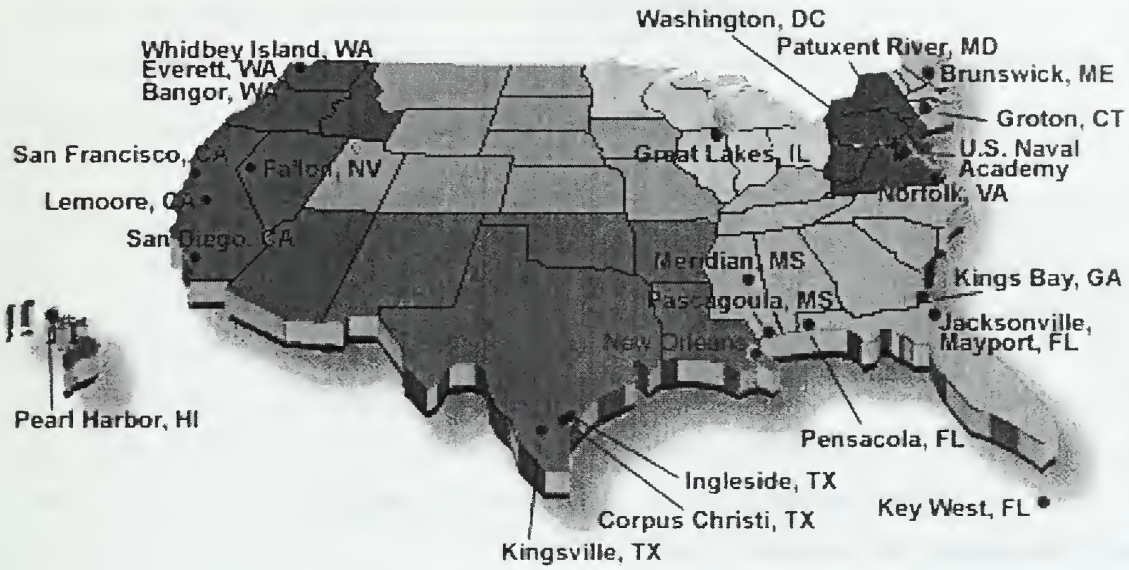

Figure 3-4: Navy Region Map

3.4.4 Family Housing, Navy (FHN)

Family Housing, Navy (FHN) includes funding for all aspects of housing including design, construction, repairs, operations, maintenance, leasing and Public Private Venture commitments. FHN funding is appropriated and distributed in a similar manner to OMN. However, installation commanders do not have the same discretionary options in FHN "stovepipes" as they do with OMN because the funding is "fenced" for housing alone. The flow chart below in Figure 3-5 illustrates the approval chain for housing budgets.

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[31] Admirals or "flags" and Senior Executive Service (SES) government employees provide leadership for operations and management within groupings called claimancies. These groupings entail geographic regions or system-specific groups such as the Atlantic Fleet or Naval Air Systems Command that are afforded discretion over appropriated O & M funds. Flags or SES personnel within these claimancies are often afforded project selection leverage in support of their "special interest groups." For example, the Atlantic Fleet Admiral may allow his individual air, surface, submarine, and regional commanders to vie for their most valued projects.

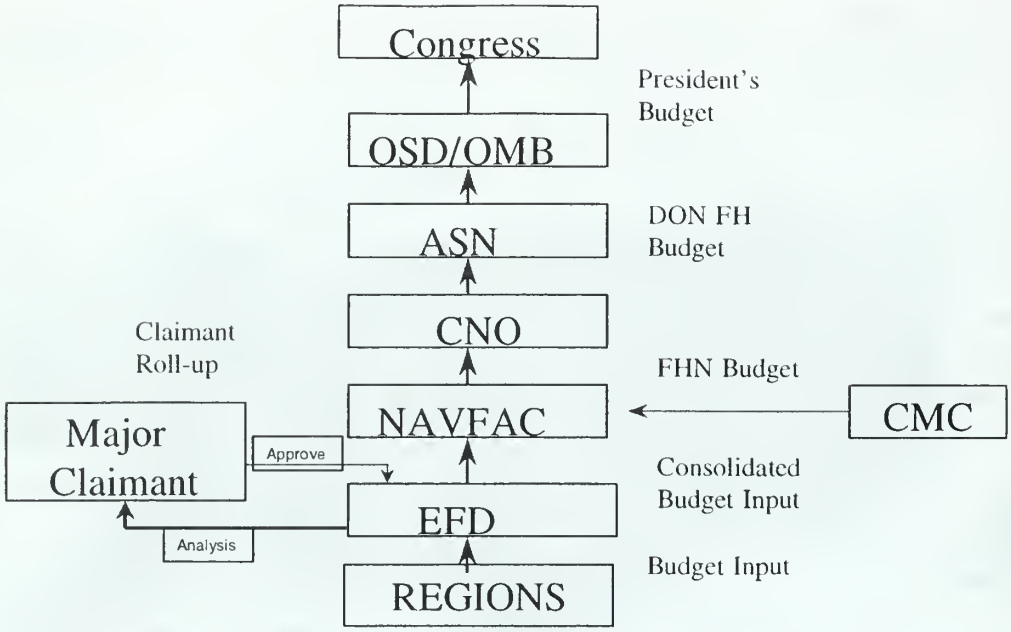


Figure 3-5: Family Housing, Navy Budget Approval Chain (Tull 1999)

3.4.5 Basic Allowance for Housing (BAH)

Basic Allowance for Housing (BAH) provides Navy families with an allowance to acquire housing on the economy near their respective duty stations. The allowance is indexed to cost factors driven by local real estate markets and members' rank. However, the current budget targets this allowance to cover only 80% of actual out-of-pocket costs to the Service Member.

The basis for BAH includes:

- Runzeimer prices equivalent housing for ranks based on size/type/income by location
- Prices for recent rentals including rental expense, renter's insurance and utilities
- Locations to be priced are selected according to "suitability" (safety, schools, crime, etc.) (Tull 1999)

BAH is used as a benchmark in PPV efforts for contractors to gauge what rental structure they can project. The service members themselves receive the allowance and pay the contractors in the form of rent. The Navy hopes that the newly implemented BAH structure will help alleviate high costs in urban and coastal areas. As discussed previously, the Secretary of Defense's most recent housing strategy places primary importance on increasing housing allowances. The goal is to reduce current out of pocket costs from 20% to zero over the next five years. (Yim 2000)

3.5 NAVFAC

The Naval Facilities Engineering Command's (NAVFAC) Strategic Plan highlights a critical area of focus relevant to base infrastructure. Specifically, the Navy's engineering arm for sustaining shore-based facilities aims at *Innovation* in developing bases for the 21st century naval forces. Within the area

of *Innovation*, NAVFAC describes its current situation as "we are cutting costs to operate and maintain an aging, inefficient infrastructure" and contrasts with a vision for the future "we will plan, deliver, and sustain efficient and effective bases for a modern, 300 ship Navy." NAVFAC enumerates the following among the strategies for realizing this future state.

- ❖ Pursue innovative planning and acquisition initiatives to reduce cost and cycle time and improve quality.
- ❖ Pursue innovative initiatives to decrease facility operation, maintenance, and demolition costs.
- ❖ Apply advanced Information Technology to reduce costs, improve management decisions, and leverage resources (Smith 1999)

These core strategies make NAVFAC a prime environment to move forward with alternative delivery and finance methods. Major realignments within legislation, funding structures, and NAVFAC's organizational structure will need to occur to enable such strategies. It has taken four years of work to put the first large wave of PPV agreements into motion, but the rudder has shifted, and momentum is gaining slowly and incrementally in the "right" direction.

3.5.1 Regional Structure

NAVFAC is headquartered in Washington D.C. and supports naval installations worldwide through Engineering Field Divisions and Activities (EFDs and EFAs). These Divisions and Activities are roughly align with the Navy operational regions identified above in Figure 3-4. Major Divisions include Atlantic, Pacific, South, North and Southwest regions which support the major naval operational centers. Smaller Activities are located in the Pacific Northwest, West (Northern CA), Chesapeake (Washington DC and Maryland), and Mediterranean (Naples, Italy) areas.[32]

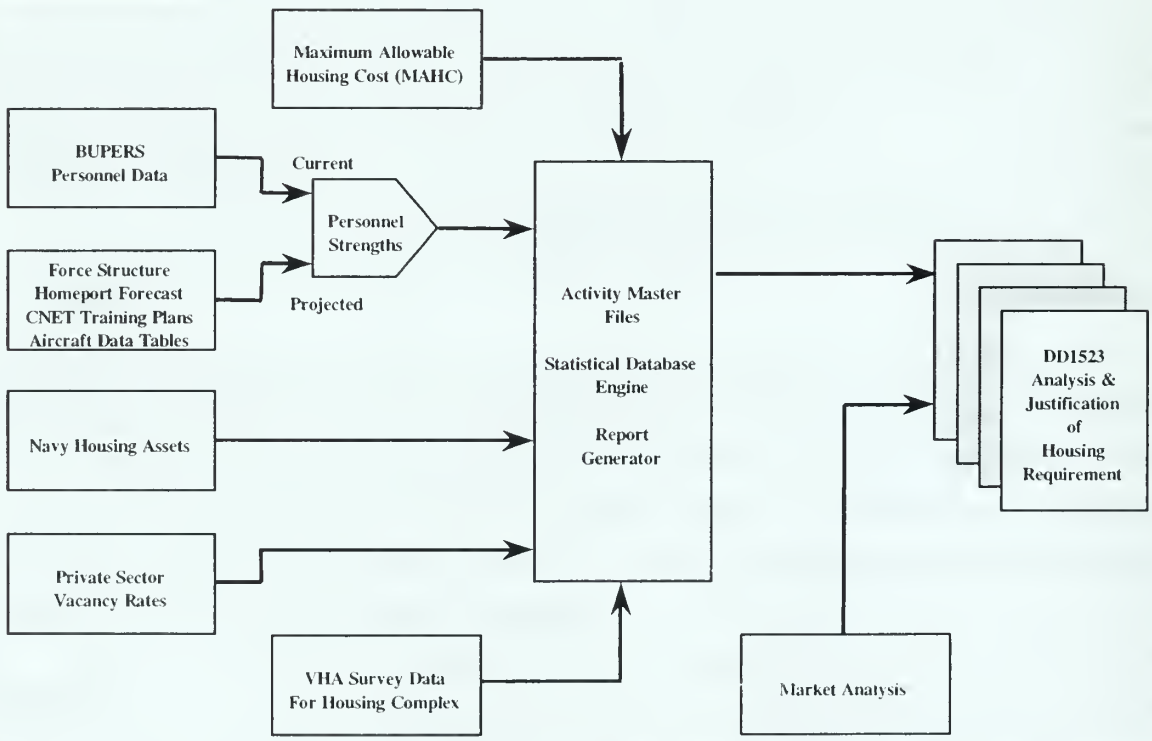
3.5.2 Staffing

At the base level where housing programs are being executed, three organizations generally exist to support housing infrastructure. Public Works Departments or Centers offer most life-cycle services to include: real estate planning, project planning, in-house design and scope configuration, design outsourcing and engineering reviews, facility maintenance and environmental planning and services. Construction contracts are executed under Officers In Charge Construction (OICC) that provide pre-construction services, contract administration, and construction management for all three services and some government agencies. Most installations are currently integrating construction contracting administration with the Public Works under a NAVFAC directive call the "New Office Model." Housing communities generally have a property management staff overseeing daily operations.

Much of the funding and programming support for housing is centered at the regional Engineering Field Divisions. The EFDs employ program managers, real estate experts, facility planners, and financial managers whose positions are less operationally oriented. This upper level management is also driven by the amount of congressional interface and scrutiny involved with such high profile projects. In the new paradigm of Engineering Systems Integration, the call for personnel with these skill sets becomes increasingly important at all levels. Since the Navy has not relied on integrated delivery in the past, the factor conditions associated with executing such programs has not been fully developed.[33]

3.5.3 Housing Requirements Analysis

The Navy's Bureau of Personnel works with the Commander, Naval Education and Training and operational commands to project base loading which in turn determines facility requirements. Existing housing assets, local vacancy rates and local market analysis are compared in light of these requirements to generate planning baselines. The process for determining family housing requirements is illustrated below in Figure 3-6. Housing programming is directly dependent on family requirements specified in annual projections of the Military Family Housing Justification (published on form DD 1523) for each installation's housing community. The current Navy Family Housing deficit is approximately 8,500 units. (NAVFAC 1999b)



[32] See NAVFAC's Base Relocation and Closure web site at http://www.navfac.navy.mil/brc/about/default.htm for a detailed map of the regions.

Figure 3-6: Housing Requirements Process (Tull 1999)

3.5.4 Neighborhood Approach

Navy-wide plans to upgrade housing communities at all bases were initiated under a Neighborhoods of Excellence Program. The resulting Comprehensive Neighborhoods Plans (CNP) for each installation provide conceptual goals and programming estimates that housing and facility personnel can use to establish viable capital and operations programs. The studies document the dire need for housing revitalization and demonstrate the respective funding requirements to attain and sustain reasonable standards.

An independent study of New London Housing by an Architect and Engineering (A/E) firm in 1996 is similar to most CNPs Navy-wide. Major goals of this CNP are to:

- Serve as a guide to bring the entire housing area to within Navy Neighborhoods of Excellence Standards, a navy-wide program.
- Identify all individual unit and community repairs and improvements required.
- Function as a programming guide to implement individual projects over time.
- Provide for implementation in accordance with Base priorities and logical phasing sequence of construction.

This and like plans are to be applied to communities as a whole where the focus is to instill a sense of neighborhood and "pride of place." At the individual housing unit level, the basic tenet is to extend the life by 25 years while upgrading to contemporary design standards. In addition to homes themselves, projects will be planned for integration of transportation and utilities, parking, family support facilities, recreational and athletic facilities. (Schooley 1996)

3.5.5 Public-Private Ventures (PPV)

To address the great backlog in DOD housing repair, renovation and construction, legislation was enacted under Section 2801 of the National Defense Authorization Act for Fiscal Year 1996, Public Law 104-106, 110 Statute 186 (10 U.S.C 2871-2885). In accordance with Secretary of Defense and Secretary of the Navy goals stated above in section 3.2.1, the Navy proceeded to standardize its approach to PPVs after an initial round of smaller agreements in Texas and Washington. The following sections provide a general overview of the goals and processes of the current PPV program.

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[33] Most project programming and O & M data supporting this thesis was gathered at the EFD levels.

3.5.5.1 Concept, Goals and Objectives

The stated goal of the Navy's PPV program is to, " ensure the availability of safe, well-located, good quality and affordable housing for DON families in the region over the long term.[34]" Specific objectives and criteria in support of sustaining the long-term goal include:

- Flexibility. Maintain a key decision position for issues concerning rents, scope development, management performance, acquisitions and sales, and any changes in technology, material and management.
- Asset Protection and Limited Liability. Protect DON investments with a series of risk controls and limit liability to initial investment.
- Life Cycle Cost Analysis. PPV process should be life cycle focused and show definite advantage in comparison to segregated MILCON and O & M appropriations.
- No Out of Pocket Expenses to tenants. Structure finance, design and subsidy required to minimally impact Service Members.
- Private Equity Leverage of greater than 3:1.
- Design Quality. Meet comparable private sector performance standards.
- Sustainability. Structure design, maintenance, operations and investment for long term use.

3.5.5.2 Preferred Business Entity

The Navy investigated numerous business entities ranging from "S" corporations to partnerships and REITs. They settled on an entity termed a Limited Liability Company or LLC. "The LLC is the preferred business entity of most regional Navy PPV projects. It is a well-understood and clearly defined partnership entity available in all states and is regulated by an established body of law designed to protect the small or passive investor (i.e. the Navy). It provides flexibility to adjust to changing market condition, allowance reform, future needs, technological change, and population demographic changes over the long term. The LLC provides protection for the Navy's value in its contributed assets and offers the Navy limited liability while at the same time enabling the Navy a degree of control over key decisions affecting the entity over the term of the agreement. The LLC Operating Agreement is the major document describing respective roles, responsibilities, duties, obligations and rights of the partners. It establishes the LLC Management Board and describes, in detail, the relative voice that each partner will have with respect to the decisions that will be made by the LLC over the term of the agreement." (NAVFAC 1999b) Limited Liability Partnerships (LLPs), the other preferred form business entities, are used where PPVs are developed on private land.

The following organizational chart in Figure 3-7 shows how the Navy's first, large LLC effort will be formed. Basically, two agreements are created to enable 1) development and 2) operations during the 50-year term. Unlike projects with typical one-time capital outlays, this arrangement will require the Navy (as Limited Partner) and the General Partner's full financial and technical attention for the life of

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[34] This quote and the following goals are taken from the Navy PPV Housing Management Guidebook. Further detail for these criteria can be found in Chapter 1 the Guidebook.

the project. It will force constant refinement and thereby enable improved delivery, quality, and service as driven by the business motives inherent to the contract.

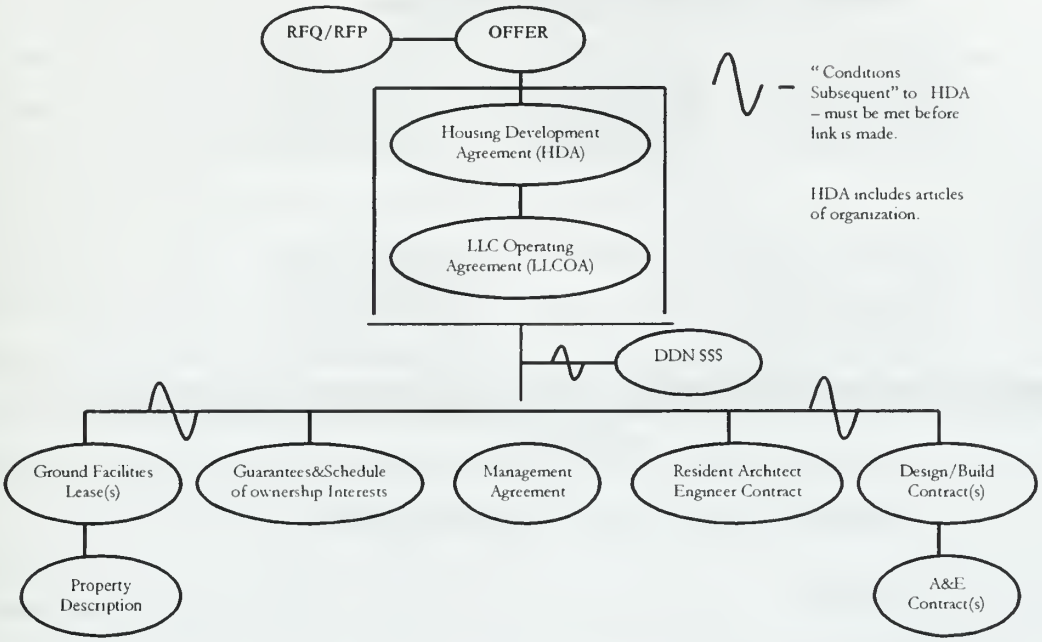

Figure 3-7: LLC Organizational Structure for San Diego PPV (Southwest Division 1999)

3.5.5.3 Acquisition Process

The Navy's PPV efforts offer a shift from traditional Quadrant IV delivery methods. Although this seems to be a modern, flexible acquisition method, the process is arduous and lengthy as indicated below in Figure 3-9. While the process is trying and requires several DOD and Congressional interfaces, it alleviates the requirement to repeat a similar process annually to fight for Military Construction and O & M funding. In essence, this process frees the LLP or LLC venture to actually plan as they now have control over cash flow, allocations and scheduling.

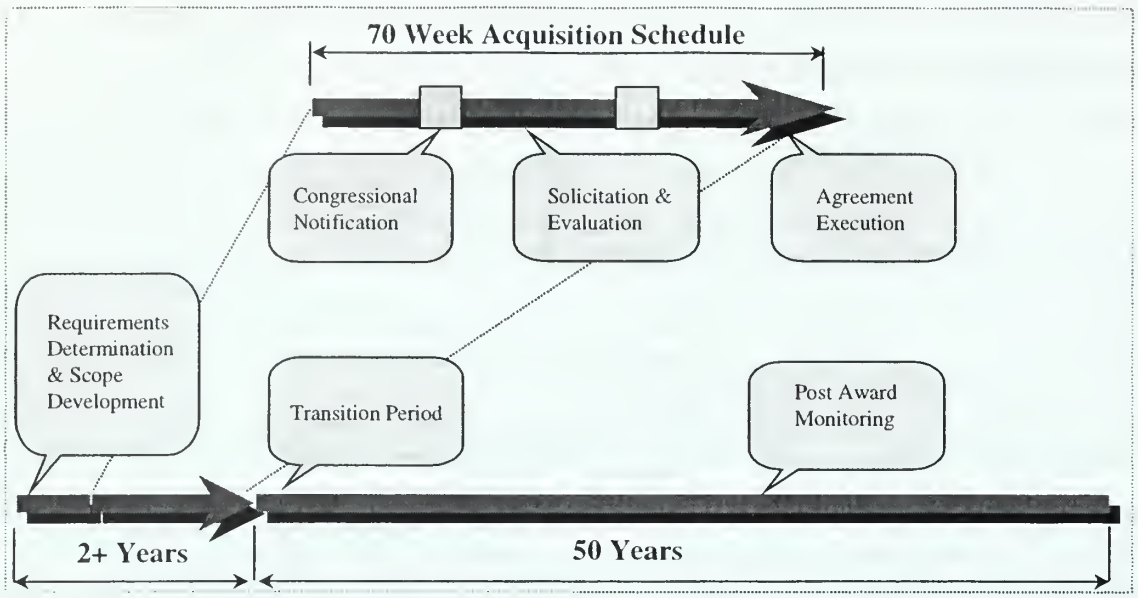

Figure 3-8: PPV Approval Processes (Cunningham 1999)

Solicitation Process

The Navy has adopted a three-step acquisition process to attract a wide spectrum of competition to its PPV offerings while minimizing initial proposal expense to the contractors. The general approach to PPV solicitations involves a Request for Qualifications, a Request for Proposals and Exclusive Negotiations.

In response to the initial Request for Qualifications (RFQ) stating project scope and population to be served, the contractors submit a Statement of Qualifications (SOQ). In the SOQ they discuss:

- Overall concepts for development and long-term management
- Past experience and performance on similar projects
- Financial capacity

Based on pre-established criteria, the four most qualified candidates are invited to submit Requests for Proposals (RFPs). The RFPs contain technical and financial details such as Site Details, Site Plans, Capital budgets, Operations and Management plans, Source and Use of Funds and Major Milestones. The financial portions of the RFPs are compared to a pro forma analysis prepared by a financial consultant. (Forrest 1999) The technical portion is reviewed by a separate board. The Navy then enters negotiations with a single contractor who was judged to offer the best overall value. During the negotiation period the winning contractor's team continues to finalize design and financial details while environmental documentation and local approvals are obtained. If negotiations cannot be suitably completed, the Navy can return to negotiations with another offeror.

3.5.5.4 Initial Efforts

In the mid-1980's, the Navy's "privatization" efforts were based on Section 801 (Long Term Leasing) and 802 (Rental Guarantee) Housing Programs. These programs allowed the Navy to enter into long-term leases or agreements by which private contractors would provide newly constructed or recently rehabilitated housing on public or private land for up to 25 years. The "801" program was moderately successful in providing 2600 new units to the Navy through 1991. The "802" program was initially restricted by a short amortization length of 15 years, and only produced one successful project before this was extended to 25 years. However, after 1991, new OMB "scoring" rules stifled these programs. New scoring interpretations required the entire value of the leases (20-25 years) to be authorized in the initial budget year. The Navy could not afford to sacrifice other programs at this expense and thus made leases dependent upon annual appropriations. Financial institutions were not willing to take the huge risk of depending on yearly appropriations and thus the financial foundation of the programs folded.[35]

The first DOD Limited Liability Partnerships authorized under MHPI were executed in Everett, Washington and at Corpus Christie and Kingsville, Texas. These were relatively small, short-term efforts that served as case studies for the current DOD-wide programs. Further details on both projects can be found in Chapter 4.

3.5.5.5 Current Program

The figures below in Figure 3-9 illustrate the Armed Forces efforts in programming DBO "privatizations" to leverage their housing budgets. While the Air Force and Army have larger projects in progress, the majority of their configurations are yet to be approved by the Secretary of Defense. The Navy and Marine Corps' program has a greater range of scope, but only one project remains to be approved by the DOD.[36] Establishing a more uniform method of delivery among the Services will be a major focal point in the coming year.

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[35] The "801" and "802" options are still available for use.

[36] Highlighted installations indicate those projects still requiring Secretary of Defense approval.

Military Housing "Privatization" Programs			
	Installation	*Scope*	*Projected Award*
Army	FT Carson	2,663	Dec-99
	FT Hood	6,631	Sep-00
	FT Lewis	4,348	Dec-00
	FT Meade	3,170	Apr-00
	Sub Total	16,812	
Air Force	Lackland	420	Aug-98
	Robins	670	Apr-00
	Elmendorf	828	Mar-00
	Dyess	402	Jul-00
	Kirtland	1890	Nov-00
	Patrick	960	Jul-00
	Dover	450	Jan-00
	McGuire	999	Feb-00
	Tinker	730	Dec-00
	Sub Total	7349	
Navy and Marine Corps	Corpus Christi	404	Jul-96
	Everett	185	Mar-97
	Everett II	300	Mar-00
	Kingsville II	150	Feb-00
	San Diego	3248	Aug-00
	South Texas	812	Sep-00
	New Orleans	613	Oct-00
	MCLB Albany	114	Feb-00
	Camp Pendelton	712	Apr-00
	Stewart Army Post	200	Jan-01
	Beaufort/Parris Isle	684	Feb-01
	Sub Total	7422	
	Tri-Service Total	31,583	

Figure 3-9: Armed Services Housing Privatization Programs (www.acq.osd.mil)

Currently PPV efforts have focused on areas where private sector housing could survive on the local real estate markets without Navy demand. This was restricted to pilot projects in Regions with the highest real estate cost and/or the most pressing housing shortages. An anomaly is Southern Division which currently has three Navy and two Marine Corps PPV projects under solicitation. Pilot projects are being managed at higher echelon levels of NAVFAC and Regional Engineering Field Divisions due to the specialized finance and evaluation skills base required. There is currently little delivery method selection or control authority at individual bases. The system has yet to evolve to the point where bases can selectively use PPV as a tool for individual projects within base portfolios Navy-wide.

The Navy's five projects consist of two more follow-on LLPs in Texas and Washington and three Limited Liability Company's (LCC). The largest LLC is currently under the solicitation/negotiation process in San Diego, California where the proposed package will build 588 new units, replace 812 and renovate 2,665. The total development cost is estimated at $151 million with the Navy providing 45% through $21 million in cash and the value of existing assets. Rental rates are not guaranteed as this would require the Navy to obligate the entire rent stream for 50 years up front. This long, 50-year agreement requires staggered re-capitalization at the 20 and 40 year marks with funding set aside in an escrow account. See Chapter 4 for further details on current PPVs in California, Texas, and Washington.

3.5.5.6 Obstacles

Although this new opportunity to leverage private capital and integrate delivery offers great potential to solve a grandiose problem, numerous hurdles need to be overcome. First, there have been numerous control confrontations with base commanders. Even though housing is not their core competency, commanders realize that housing is a key Quality of Life issue and are leery of divesting its control. They tend to take an elevated personal interest housing issues and often try to provide more than is economically feasible. Next, each service is pursuing a unique approach to housing delivery integration. Their uncoordinated efforts are sending mixed signals to the private sectors they wish to attract to these new business segments. Currently, individual services are developing standard guidelines based on early PPV efforts. However, their staffs have been delivering housing in the same manner for almost fifty years and they were not structurally aligned to configure such solicitations. Third, along with standardizing their PPV solicitation process, the services are experimenting with which Request for Proposal processes will elicit the greatest competition. They are trying to limit contractor proposal costs through Request for Qualification processes which prevent a great number of competitors from expending the $200-$500 thousand to put together a complete proposal package. Next, the DOD wants more than it can afford. Basically they are asking for new or renovated single-family homes or townhouses for extremely low rental rates that may only support apartments. Either the space requirements need to be eased or the housing allowances need to be increased to close this gap. Lastly, in most cases, the debt service incurred by the private sector will not be covered by the rent streams. Therefore, some subsidy[37] in the form of land and housing conveyance or Differential Lease Payments must be arranged. These issues are directly tied to local real estate and finance trends, but the government RFP process and housing allowance system is often too cumbersome to respond accordingly. Despite all these obstacles, the DOD is currently learning under pressure and will systematically work the requirements, funding, and configuration issues out as they award and execute the recent round of contracts.

[37] The ugly "s" word, subsidy, will work against the competitive system in the long run. Eventually, the Service needs to structure a housing system the will "stand alone" on its own merits.

4 Case Studies

The following case studies were developed to compare the application of different delivery methods for naval family housing portfolios. Housing is just the first example of an infrastructure collection that will be delivered differently by the Navy in the coming decades. While all naval bases in the United States have DBB, a curious form of DB, and a several forms of DBO available to them for contract execution, alternative methods of DB and DBO are being used selectively at bases predominantly in the South and West. The case studies progress from bases where DBB is used exclusively to bases that increasingly utilize a mixture of methods to carry out portfolio execution. This analysis includes housing programs from New London, Connecticut; Roosevelt Roads, Puerto Rico; Ventura, California; Corpus Christi, Ingleside, and Kingsville, Texas (South Texas); Everett, Washington; and San Diego, California. Utilities and other services will follow closely behind. Housing provides an interesting first example of how the Navy might attack the delivery of mission critical support services.

4.1 CHOICES© Modeling and Assumptions

4.1.1 General Approach

As discussed in Chapter 3, the CHOICES© decision analysis software was used to portray housing cash flows for several naval bases in the United States. Historical Operations, Maintenance, and Leasing and Projected Capital Costs were collected and used to establish portfolios for each base. Based on the foreseen possibilities of delivery methods, finance and breadth of scope, alternative delivery packets were constructed as variables for individual projects.

In general, all projects were modeled for Design Bid Build (DBB) delivery as a baseline. This is the most typical type of delivery encountered and authorized. For most projects with exception of historical renovations, Design Build (DB) packages were added. This method is a viable alternative using the same funding sources and is allowed under the Federal Acquisition Regulations (FAR 36.301).

For larger projects, bundled at a minimum of 100 units, Design Build Operate packages were created using differing percentages of private capital and Military Housing Privatization Initiative (MHPI) "seed" funding. Where Navy housing and land was to be conveyed as part of a Public Private Venture (PPV), cash contributions were a lower overall percentage of the development costs ranging from 11-15%. Total Navy equity in these ventures is allowed up to 45% of development costs. (10 USC 2871-2885 1996). Where Military Construction of new units was programmed, the Navy MHPI contribution was set at 33% to represent the legislative limit for contributions to development on private land without conveyance of existing assets. Where PPV development on private land was possible, Navy cash contribution was also set to 33% of total development costs. In these packages, funding streams required

to support future Operations and Maintenance (O & M), were modeled using 100% "User Fees" in lieu of "New Resources." "User Fees" are the rent stream from BAH, however, their apportionment is no different than that of "New Resources" which represent additional funds required to keep net cash flow in each planning period at zero.

In some cases, scope was altered, particularly in the case of South Texas. Here almost the entire region will be privatized, so most future projects are included in ongoing PPV efforts. To contrast the methods, the individual projects were separated and recombined as one portfolio to be compared against the aggregate PPV portfolios for Corpus Christi and Kingsville.

Another issue relevant to scope was the pace at which the projects were executed. Since no pace indication was available with the data collected, execution of 25 houses per quarter was assumed for renovations and 50 houses per quarter for new construction. An additional two quarters time was added to new construction projects to account for mobilization/demobilization efforts common to all projects.

Project Zero (P0) projections included funding from BP10 Services, BP11 Management, BP12 Utilities, BP14 Furnishings, BP20 Maintenance and BP 15 Leasing. Leasing would not normally be incorporated in P0 projections, but it was included in these scenarios as it would otherwise be difficult to capture in project packaging. In areas where housing communities were being merged (Ventura) and where leasing requirements were brought on by PPV efforts, significant, one-time deviations in expenses would cause unrealistically steep projections in P0. In such cases, the historical figures were valued by discounting the current year figure by 3% to facilitate a smooth projection.

4.1.2 Assumption of Constants

As discussed in Chapter 3, the user can alter several "Constant" inputs for O & M costs, sources of funding, and interest rates. For these portfolios, O & M interest rates expressed at a percentage of construction cost were assumed to be 6% for DBB, 5% for DB and 4 % for DBO. Funding sources were changed from State and Federal Sources to Military Housing Privatization Initiative (MHPI), Military Construction (MILCON), Family Housing, Navy (FHN) and Private Equity. Interest rates for construction debt and discount rates were left unchanged.

4.1.3 Some Modeling Anomalies

The majority of capital improvements are rehabilitation or ":revitalization" projects which already have O & M costs represented in the P0 projections. Unaccounted for in the modeling is the degree to which historical costs represented in Project Zero (P0) projections are reduced by PPV efforts. For new construction, the model holds.

Although project data was collected from 1997 to 2007, those projects starting prior to the year 2000 were often excluded from the portfolio. Here pre-construction and construction funding streams

were often expended before the current year transition between P0 and project package aggregations. The model incorporated O & M data as categorized by Budget Program (BP) codes identified in Chapter 3 through the year 2000. At this point of demarcation, the cash flows of the project portfolios are aggregated on top of the P0 projections. The software maps out planning, programming, permitting and design costs back to where they should typically (or ideally) be started. So, for the majority of project packages, the construction start date was projected beyond its planned date to allow for the entire pre-construction cash flow templates to be distributed. Once the appropriate cash flow distribution was established (see Stretcher Template in Chapter 2, Figure 2-7, for an example), portions that would occur prior to Year 0 (Year 2000) were truncated and the cash flow template was re-applied using a "Cascade" function. This process allowed modeling as close to actual projections as possible, however, it also created some small errors in the allocation of funds where multiple sources were used. For example, if some of the planning and/or construction costs were truncated, the primary source of funds (normally MHPI Navy Funds) would be drawn until exhausted whereupon private capital would be drawn. This makes a slight difference in the graphical representation of the funding sources, illustrating more Navy contribution than expected. This is negligible where PPV (and thus MHPI) funding represents a small percentage of the portfolio. These truncations also caused "spill-over" from "Cumulative Resources" carried forward from years prior to 2000 resulting in large spikes in "New Resources" required. These were deleted from the graphs assuming that all funding would have already been expended as previously scheduled.

4.1.4 Cash Flow Feasibility for PPV Projects

A more realistic net income pro forma can be modeled via substitution of estimated Net Operating Income discounted cash flows in place of the "user fees" where feasible. This is possible in separate cash flow analysis for San Diego, Texas and Everett where housing and rank/rent distributions were made available in public solicitations. Here the projected BAH rent stream would be shown while accounting for recapitalization plans, estimated O & M, and taxes. This approach utilizes the CHOICES© software to generate projected cash flows for varying scenarios. In a separate analysis, Net Present Values for these cash flows can be generated while varying controls such as, length of term, and discount rates. Sensitivity analysis can be conducted to show, in general, what controls have the greatest effect on the financial structure of the ventures. A pro forma for San Diego was generated to illustrate these aspects.

4.1.5 Outputs: Graphical and Numerical Comparisons

Cash flow graphs were generated for each base portfolio in three basic configurations. The first representation shows all packages executed by DBB. The second sets represent mainly DB. Where DB

was not plausible, such as for an ongoing DBB project or an historical renovation, the DBB packages were left in place. The last configurations represented the maximum use of integrated delivery methods with DBO packages being applied wherever possible. Those portfolios that most closely represent the current portfolio execution plan as well as more integrated plans are illustrated within each case. These cash flows were summarized into general comparisons contrasting total scenario outlays for DBB verses DB and DBB verses DBO. Numerical summaries are also presented comparing each portfolio configuration.

4.1.6 Drivers for Specific Installations and Projects

In order to support implementation of a portfolio-oriented infrastructure strategy, planners need practical tools to determine which delivery methods are viable for specific projects. As discussed in Chapter 2, Massachusetts Port Authority's Christopher Gordon has described a method that has proven successful in a quasi-public environment. This dynamic approach to eliminating poorly suited delivery methods supports package configuration within CHOICES©. Only through a balanced approach of alternative and typical project delivery can modern infrastructure systems be continually upgraded at a pace that will support repair as well as growth. The following discussion highlights pertinent drivers that would affect project delivery selection at the bases presented in the following Case Studies. Market and Drivers for each installation will be further discussed in each individual case. Specific examples of tool implementation will be presented for the San Diego Case as it represents the largest commitment to alternative delivery thus far in the Navy's housing program.[38]

4.1.6.1 Project and Owner Drivers

The Case Studies generally did not seek the level of detail to allow full Project Driver analysis with the matrix tool developed by Gordon. However, enough detail was gathered in the San Diego Case to conduct the analysis that is covered below in detail. Generally, the pre-determined process of military infrastructure acquisition limits most projects to General Contractor and Design Build, Fixed Price systems. When authorized (or pressured) by legislation to pursue Quadrant I delivery, the Project Driver Matrix is limited Build Operate Transfer (actually Design Build Operate) projects due to the need for construction and permanent financing. Obviously, the system is driven top down instead of allowing the regional infrastructure stewards to develop their own solutions.

Owner sophistication and involvement is fairly uniform at the regional level. The Naval Facilities Engineering Command is a sophisticated owner. The Civil Engineer Corps and its supporting

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[38] While San Diego will outsource over 3000 housing units, this only represents 1/3 of their entire stock. Small installations/areas such as Everett and South Texas are converting their entire inventories to outsourced delivery and management.

NAVFAC civilians form a well-educated and dedicated infrastructure team that are constantly innovating, within the constraints of current regulation, to upgrade an aging and unwieldy infrastructure. As shown in Chapter 2's Owner and Owner Involvement, they are capable of executing almost any form of delivery method available. Most organizations are not staffed to enable a multiple prime team, however they have in the past and could do so, if deemed necessary. On the other hand, the DBO realm of PPVs has presented new challenges that cannot be fully met with the current staff configuration. NAVFAC does have the personnel required to carry out these processes at the regional and headquarters levels, however, they are currently in high demand and low on experience due to the history of pre-determined delivery paths over the past 50 years. One anomaly is the "home base" for the Civil Engineer Corps in Port Hueneme, California where there appears to be a good mix of delivery methods. This is directly linked to the cluster affect of NAVFAC personnel and activities there. Owner involvement will change more than owner sophistication as workload differs with local trends and leadership. Owner involvement will be dictated mainly by 1) local leadership embracing new methods and 2) availability of required staff at the region and base level. For example, neither Naval Station Everett nor Engineering Field Activity Northwest have enough qualified, permanent staff to support local PPV efforts. However, their parent Engineering Field Division in San Diego supports alternative methods and also has the real estate, finance, legal and contractual expertise to support them on a contract by contract basis.

4.1.6.2 Market and Political Drivers

The three cases involving Quadrant I delivery methods were New London, Connecticut; Roosevelt Roads, Puerto Rico; and Ventura Naval Complex, California. All three bases are moderate in size and serve diverse purposes such as submarine home-porting; battle group training; weapons testing and construction battalion home-porting respectively. They also have very unique market drivers as they are located in distinct regions. As discussed in Chapter 2, market fragmentation will have a significant effect on housing delivery in each region.

Everett, Washington and Corpus Christi, Texas were the first sites for military PPVs. Their early application was driven by the lack of adequate housing for military members on the local economy. These large housing deficits created markets for private sector housing

4.2 Design Bid Build Delivery

The baseline of this paper's portfolio analyses is established in the following case studies where DBB is the only method currently being used to execute housing contracts. As discussed in Chapter 2, DBB forms the baseline of comparison for alternative methods as it the most prevalent delivery method and presents numerous facets that can be improved upon. All bases in the following studies use DBB as a

standard delivery method, so this was a logical place to start. Here portfolios from New London, Connecticut, and to a lesser extent, Roosevelt Roads, Puerto Rico are depicted.

4.2.1 New London, Connecticut

4.2.1.1 Regional Background

Sub Base New London has emerged from a small Navy Yard established in 1872 to a vibrant operational base. The mission of the Sub Base is to support the operational needs of 23 Atlantic Fleet Submarines, and to support the administrative and Quality of Life requirements of 7000 military and civilian employees of the base and their families. Many of these personnel live in the Navy housing units adjacent to the base.

The housing mission, typical of many Navy housing offices, is to support the base's family housing needs through private referrals or Navy assets. New London has nearly 2,500 housing units at their disposal. These communities were built between 1874 and 1983 and require extensive revitalization estimated at $250 million as illustrated below in Figure 4-1. The base long-range plan establishes the goal of refurbishing all single and married housing over a seven-year span. (Moore 1997)

The New London Housing Division manages the operations and maintenance of all housing supporting the base as well as communities in Chicopee, Massachusetts and Fairfield, Connecticut. Similar to other base-level offices, their intermediate planning and fiscal programming support is provided by the regional Engineering Field Division and Regional Operational Command. For New London; these consist of the Northern Engineering Field Division in Philadelphia, Pennsylvania and the Commander, Naval Region Northeast also located on the New London Submarine Base. All capital planning, programming and O & M budgeting issues flow through these entities.

In interviews with regional and local housing offices, directors expressed interest in exercising alternative delivery methods like PPV, but are restricted by Office of Management and Budget project scoring criteria and other regional efforts. Ability to execute PPV projects depends on NAVFAC's demonstration of significant savings in capital costs, maintenance (20%) and utilities (10%). (Little and Beeler 1999)

No New England sites have been able to accomplish such ventures. The selected privatization pilot site at Brunswick Naval Air Station, Maine, was on the verge of awarding a housing privatization agreement until BAH rates were recently projected to drop 20% in the area. Another Marine Corps attempt at Chicopee, Massachusetts failed for similar reasons. New London Sub Base was not considered because only one pilot project was authorized per Navy Region. (Cunningham 2000) Accordingly, a feasibility pro forma was not established.

4.2.1.2 Market and Political Drivers

New London's situation is dictated by both policy and local market drivers. The submarine base was left out of the PPV studies in favor of other bases in the region. Opportunity for other delivery methods may open up in the future as MHPI legislation is extended and the first LLP and LLC projects gain momentum. The local construction market is very tight as regional development pace is currently high. Large requirement in Boston's "Big Dig," and local Native American casino development have diminished local availability of contractors and caused construction costs to rise. Additionally, the Navy's BAH structure has not aligned accordingly. New London has some prime real estate that it can leverage in future integrated developments, when authorized.

4.2.1.3 Specific Modeling Issues

The current base loading projection for year 2004, predicts 2125 on-base housing assets will be needed to supplement projected and private sector availability. Included in the analysis is a scan of the local community that estimates it can support approximately 1500 rental units for naval families. To support sustaining such an inventory of Navy-owned houses, a study called a Comprehensive Neighborhoods Plan[39] (CNP) was initiated. Per the CNP findings, the costs associated with revitalization or replacement of housing in six established communities is summarized below in Figure 4-1.

Community	Total
Polaris Park	$13,328,000
Dolphin	$34,808,000
Nautilus Park	$135,008,000
Conning	$19,230,000
Trident Park	$29,436,000
On Base	$8,849,000
Fairfield,	$3,459,000
Total	$244,118,000

Figure 4-1: New London Community Revitalization Estimates (Schooley 1996)

Capital Improvements Program

Specific execution details for the individual projects and project "packages" within communities that were input into CHOICES© are depicted in the following format:

New London Family Housing Projects by Fiscal Year

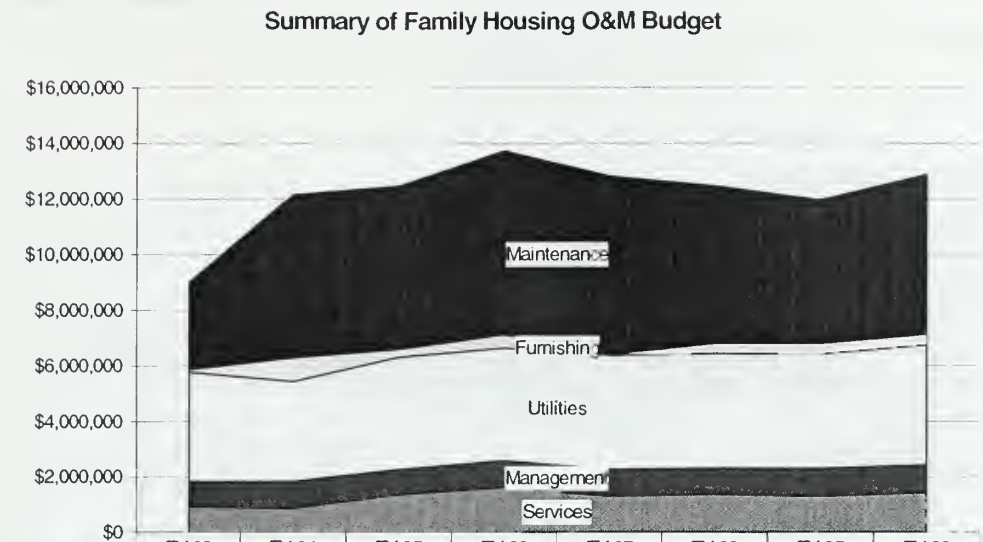
Project No.	FY	Housing Area	Project	Cost Est.	Project Start (2nd Qtr of FY)	Project Duration (in Qtrs)	Funding Source
*	98	Dolphin Gardens	Demolition 4 units	$62,000			
*	99	Dolphin Gardens	Demolition 14 units	$323,000			
1	00	Nautilus Park II	Phase I - Revitalize 72 units	$6,321,000	2	6	MILCON
2	00	Nautilus Park II	Phase II - Revitalize 70 units	$8,081,400	2	6	MILCON
3	00	Mitchel Complex	Mitchel Manor - Revitalize 276 units	$60,790,000	2	12	MILCON
4	00	Mitchel Complex	Self Help Center BP-22	$340,000	2	2	O&M
5	00	Dolphin Gardens	Demolition 382 units	$9,600,000	2	6	MILCON
6	01	Nautilus Park	Phase I - Revitalize 111 units	$11,104,200	6	6	MILCON
7	01	Nautilus Park II	Phase III - Revitalize 184 units	$20,963,300	6	8	MILCON
8	02	Nautilus Park	Phase II - Revitalize 101 units	$10,300,000	10	6	MILCON
9	02	Nautilus Park II	Phase IV - Revitalize 148 units	$17,399,900	10	8	MILCON
10	02	Nautilus Park III	Phase I - Revitalize 200 units	$7,693,200	10	6	MILCON
11	02	Polaris Park	Demolition 148 units; Add 100 units	$20,150,000	10	8	MILCON
12	03	On Base	Revitalize 40 units	$2,147,000	14	4	MILCON
13	03	Trident Park	Phase I - Revitalize 144 units	$8,800,000	14	6	MILCON
14	03	Nautilus Park	Phase III - Revitalize 100 units	$10,540,100	14	6	MILCON
15	03	Nautilus Park III	Phase II - Revitalize 50 units	$4,525,000	14	4	MILCON
16	04	Trident Park	Phase II - Revitalize 120 units	$7,368,000	18	6	MILCON
17	04	Nautilus Park	Phase IV - Revitalize 187 units	$20,222,400	18	8	MILCON
18	05	On Base	Revitalize 8 units	$713,100	22	3	MILCON
19	05	Fairfield	Revitalize 28 units	$2,585,300	22	4	MILCON
20	05	Trident Park	Phase III - Revitalize 136 units	$8,300,000	22	6	MILCON

Notes: * - Projects not modeled; future year study starts in FY 00
- Time starts at quarter 1 of FY 00

Figure 4-2 New London Housing Program CHOICES© Input (Beeler and Moore 1999)

O &M History

The Budget for Family Housing O & M (FHN) for New London has hovered around $12 million dollars annually. This budget is fenced specifically for housing and cannot be used for any other purpose as was discussed further under Types of Funding in Chapter 3. The following graph in Figure 4-3 shows the breakdown of budget categories Maintenance, Furnishings, Utilities, Management and Services. Of these, Maintenance and Utilities account for over 80% of the total O & M expenditures. Similar information was gathered for all bases in this study. This data forms the historic data (P0) which is then used to calculate future trends.



	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00
Maintenance	$3,155,800	$5,844,100	$5,877,600	$6,605,900	$6,408,700	$5,623,800	$5,136,400	$5,731,100
Furnishing	$86,400	$863,800	$282,000	$481,200	$34,500	$390,400	$390,400	$390,400
Utilities	$3,953,900	$3,591,400	$4,040,500	$4,061,800	$4,111,600	$4,125,300	$4,125,300	$4,326,800
Management	$904,000	$989,900	$914,900	$964,900	$949,300	$939,900	$988,800	$1,001,100
Services	$912,700	$851,800	$1,344,300	$1,614,300	$1,320,900	$1,373,500	$1,304,800	$1,426,300

Figure 4-3: New London FHN History (Beeler 1999)

All projects were fitted with DBB and DB packages. However, only the four projects that the New London housing office identified as potential PPV projects were modeled as DBO. For these projects, a Navy initial cash outlay of 33% was assumed. Unlike like programs with PPV efforts already planned, conveyance of government assets was not determined, so a rate between 10% and 33% would have been reasonable depending on how much equity was offered in land and existing housing. The followed approach yielded conservative figures by offering more government funding than would be available with real property conveyance.

4.2.1.4 Cash Flow Analysis for DBO Packages

A basic pro forma in Appendix A illustrates a method to assess what rental stream would be required to make these projects viable through a DBO venture. Here, it was used to determine an approximate revenue stream required to generate a positive Net Operating Income (NOI) for the four projects New London identified by the housing office as PPV candidates. Sensitivity analysis was performed to find where rent thresholds.

Assuming average distributions where E5 and O3 BAH ($688 and $885 / month respectively) were the median rents, several of these scenarios may be feasible if Differential Lease Payments (DLP) were utilized. However, without significant initial subsidy it may be difficult to make the Dolphin

Gardens or Polaris Park projects viable. A more detailed cash flow analysis was executed in the San Diego case (Section 4.5.1.5) where specific rent distributions were available in the solicitation.

4.2.1.5 Portfolio Comparison

Aggregate Numerical Comparison

New London Comparison

	DBB	DB	DBO
Revenues			
P0 Revenues	597,273	597,273	597,273
MILCON	290,746	249,443	205,891
New Resources	231,954	216,238	173,543
User Fees	0	0	93,683
Subtotal revenues	290,746	249,443	299,574
Expenses			
P0 Expenses	530,897	530,897	530,897
PO Adjustments	66,376	66,376	66,376
Capit Prgm Viab Advert	3,539	3,583	4,183
Permit'g Compet(s) Design	19,702	17,868	19,617
Construction	267,505	245,377	219,850
M&O	231,954	198,853	228,858
Total Costs with Debt Serv	522,701	465,681	472,509

Figure 4-4: New London Aggregate Cost Summary Comparison

Three portfolios were configured in DBB, DB and a combination of DBB and DBO. The numerical comparison in Figure 4-4 demonstrates the differences in revenue and expenses in the contrasting portfolios. The decreasing trends are most evident in the rows above titled: Total Costs with Debt Service under "Expenses" and MILCON and New Resources under "Revenues." DBO revenues appear to increase over DBB, however, when New Resources are considered, a savings of over $50 million is evident. MILCON funding was identified as the main source and Private Equity was not accounted for as in the remainder of the case studies. Therefore, use of Private Equity is represented in a decrease in revenue and expenses as more indirect funding is used. This is illustrated graphically as the "saddle" below in Figure 4-6. In further scenarios, more specific tracking of funding sources is available.

Design Bid Build: Existing Portfolio

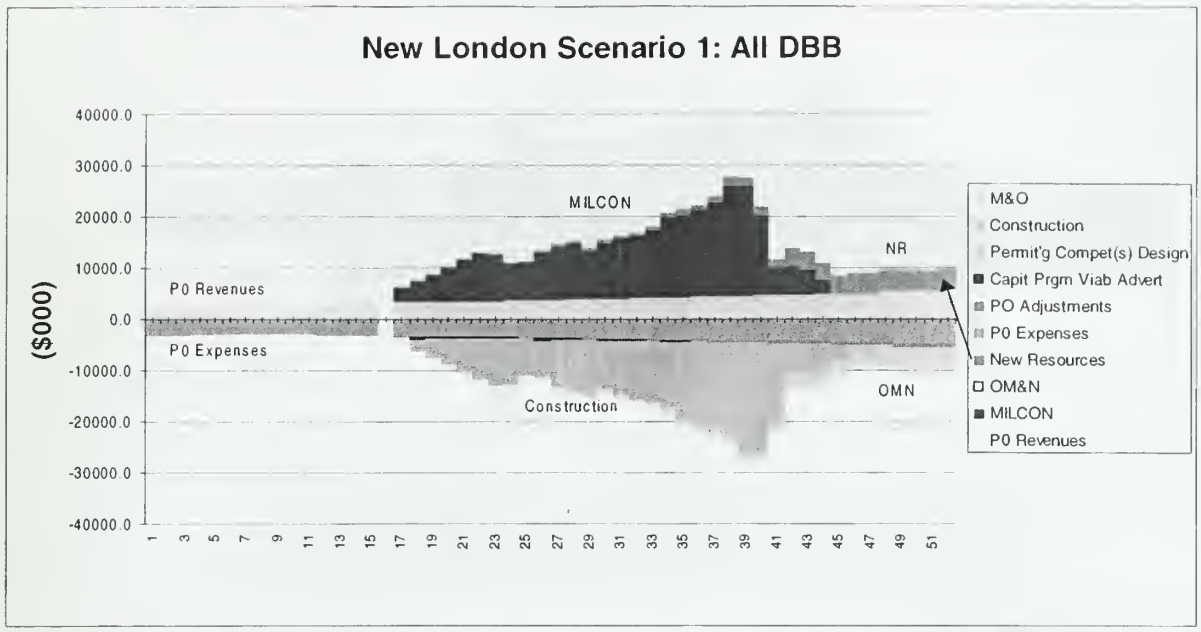


Figure 4-5: New London DBB Scenario

The CHOICES© "Chooser" graph in Figure 4-5 illustrates the cash flows from a homogenous DBB portfolio. Portfolios in this paper are generated within a seven---year planning cycle, which results in the tapering effect toward the end of the graphs. This is the most likely portfolio outlook for New London as DBB is very predominant in their execution strategy. All estimates used to generate this and like cash flows are shown in figures titled, "Housing Program CHOICES© Input" for each specific base.

DBB v. DB

For illustration purposes, another scenario was run using all DB packages. The comparison is shown in Figure 4-7 where DB is a dotted line against the opaque backdrop of the DBB baseline. This comparison was run for all case studies, but will only be shown in comparison graphs unless DB is a predominant form of delivery in that case study. Using DB on all projects saves nearly $25 million in capital funding requirements and another $33M in Operations and Maintenance expense over the life of the project. Summarily, DB also serves to deliver the portfolio three to four quarters earlier. These savings are based on CHOICES© templates. Actual results would vary with local market conditions, however, the trends would be similar.

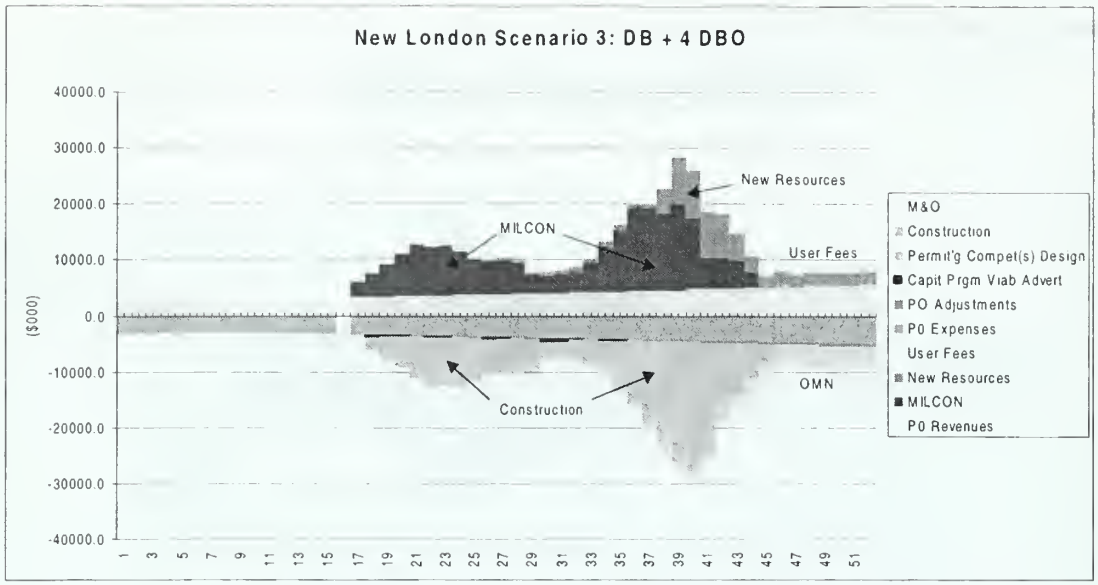


Figure 4-6: New London Cash Flow for Integrated Delivery Portfolio

DBB v. Integrated Approach

The DBO scenario is illustrated in Figure 4-6 with 14 DBB projects and four DBO projects to represent a plausible mix in lieu of creating a scenario with only DB or DBO projects. While only four of the projects are executed with the DBO method, this shows potential saving in capital costs of approximately $45 million. Although maintenance cost savings are gained, their effect is diluted in comparison to the full DB portfolio due to the small percentage of projects under the DBO system as proposed by the base. Depending upon your view of Basic Allowance for Housing (BAH), shifting fund sources to "user fees" could be seen as savings of over $90 million. However, this is merely a shift in funding sources whereby the contractor is paid indirectly via the Navy tenants who collect BAH allotments. In the DBO case, initial capital costs are deferred significantly and distributed more evenly over the life of the project. Figure 4-7 shows how small, leveraged, initial investments in Capital Program Viability yield the long-term benefit of consistently lower and less cyclical capital outlays.

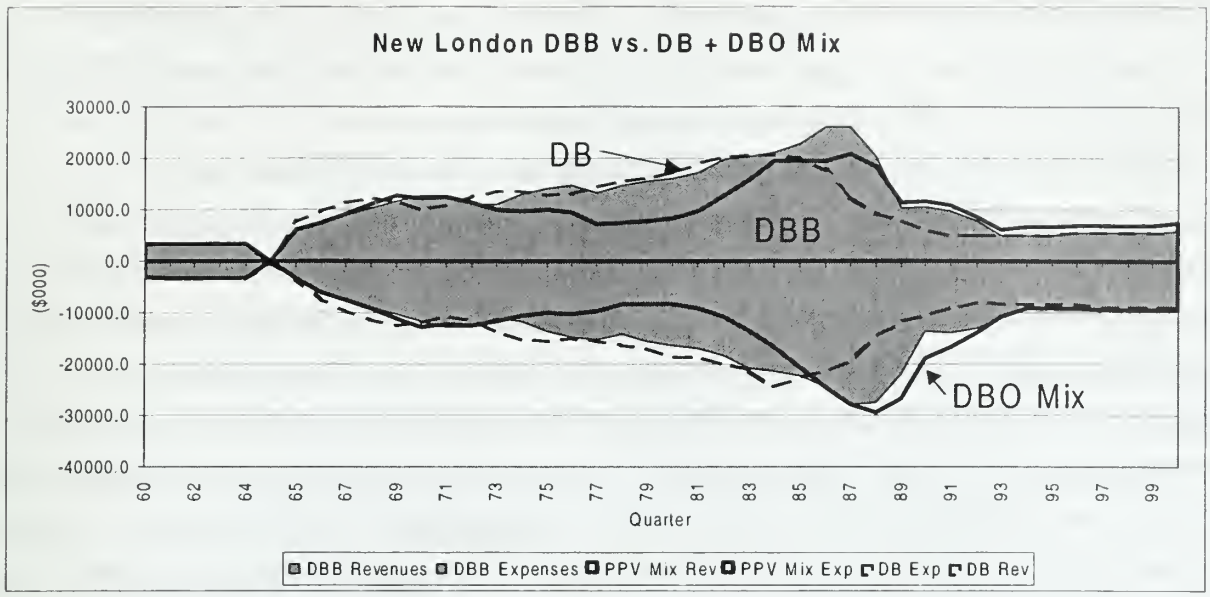


Figure 4-7: Aggregate Comparison of New London DBB v. Integrated Cash Flows

4.2.2 Roosevelt Roads, Puerto Rico

4.2.2.1 Regional Background

Naval Station Roosevelt Roads (NSRR), Puerto Rico occupies approximately 10,000 acres of land on the eastern shore of the mainland outside the town of Ceiba, and nearly 20,000 acres on the neighboring island of Vieques. In conjunction with surrounding air, surface and subsurface training ranges, it provides the Atlantic Fleet the unique capability to train in full Battle Group scenarios all year round. Operations continue to expand with the influx of Defense Components merging from the recent closure of the Panama Canal. The resulting growth has put a heavy strain on the base infrastructure, housing and school systems.[40]

While there are no warships, submarines, or tactical aircraft "homeported" at NSRR, there exist airfield, port and range facilities to accommodate a full battle group or equally large exercise contingents. In addition to U.S. training, it is also used extensively by NATO and South American Navies. To support year-round service to the Fleets, the base maintains a military population of 3,000 personnel, roughly half the size of New London.

Similar to New London, NSRR is currently undergoing major family housing renovations. Approximately 60 % of the housing areas are now under construction. A Comprehensive Neighborhoods Plan (CNP) was developed for housing communities to provide a sense of neighborhoods, conceptual planning and corresponding estimates. NSRR was divided into several communities similar to New

London. Their current revitalization program entails approximately 750 houses. The housing facility engineer reported that cost associated with this CNP were four times that of current programming. (Torres 2000) Accordingly, most of the work is focused on interior improvements.

Currently few alternative delivery methods are being utilized in the Caribbean outside of contingency matters. (Taylor 2000) In contingencies like hurricanes, a Cost Plus contracting method called CONCAP has been successfully used to increase the pace of recovery. The new base commissary was executed by the Defense Commissary Agency with the "federal funny" DB, however, construction was delayed by over a year. Potentially this failure, the perception of a lack of capable firms, or the smaller nature of typical projects has prevented further use of alternative methods. However, the local government has been able to pursue alternative methods on larger projects. NSRR has an infrastructure plant value of over $2.0 billion with major water, wastewater, solid waste, power, airfield and port systems and facilities. Certainly there is room for improvement of their portfolio management should funding and planning paradigms permit.

Local Commonwealth efforts have been open to newer methods for large projects. First , the Teodoro Moscoso Toll Bridge connecting the San Juan Airport to Rio Piedras was executed using a DBO concession to Autopistas. (ISDR 1997) Next, the Superaqueducto project, bringing water to San Juan from Arecibo, was executed using a modified form of Design Build. (IDSR 1999a) On the finance side, new toll roads are being used to generate revenue to pay for the Puerto Rico Highway Transit Authorities construction program and debt service. (Almodovar 1999) Finally, the Tren Urbano, linking most of San Juan's metropolitan area with light rail, is a major undertaking with under the leadership of Siemens Transportation Partnership. They are overseeing six design build contracts for stations, all rail and rolling stock procurements and installations in addition to five years of operations. (Almodovar 1999) Such a series of alternative project deliveries indicates that the local market can support integrated project delivery and indirect finance methods.

4.2.2.2 Market and Political Drivers

Puerto Rico is considered "overseas" for many contracting and military assignment purposes, but the local infrastructure development strategies mirror the Commonwealth's current "stuck in the middle" political status. First, the base at Roosevelt Roads executes almost entirely by DBB methods although the most significant projects on island are being executed by integrated delivery methods for the Commonwealth in the San Juan metropolitan area. Certainly there are adequate and qualified contractors available to support alternative methods. In fact, many of the contractors involved in San Juan's projects have come from the mainland U.S. and Europe. Next, Puerto Rico is the most remote base studied and

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[40] Roosevelt Roads falls under the Southeast Regional Commander based in Jacksonville, Florida. They are also

the one most affected by foreign influence, however, the Buy American Act remains is still in place there. Unlike other overseas bases where local methods and materials are embraced or accepted, all materials must meet these standards regardless of the cost implications. Third, there is a large infrastructure gap between the base and the local communities that fuels the need for on-base housing. Unlike much of the island nation, the base has a reliable water source and treatment, modern wastewater treatment facilities, and backup power for critical buildings. Additionally, base housing standards are much higher than that of the local communities, providing more space and air conditioning in addition to the reliable utilities. Lastly, local market conditions may be overridden by the heated political contest over the island of Vieques. After over fifty years of American and Allied use the ordnance range on it's eastern shores, the local population and government is working fervently for return of the property. This may effect any long-term contractual structures at Roosevelt Roads as the base exists to support operations on Vieques and other local air and underwater ranges.

4.2.2.3 Specific Modeling Issues

Unlike New London, data for BAH rates, housing programming, and CNP information was less accessible. However, contact with the housing and contracts offices of NSRR and Atlantic Division yielded historical, ongoing and programmed housing data. The following figures represent the historical budgets and current housing program for Roosevelt Roads.

Housing O & M costs hover near $8.0 million lagging New London by $4.0 million, yet inventory is nearly half that of New London. Without further accounting data and full inventory information on Roosevelt Roads housing, it is difficult to conclude where this major difference in O&M costs originates.

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supported by the NAVFAC's Atlantic Division in facilities and engineering matters.

Naval Station Roosevelt Roads Housing Improvements Program

Project No.	Award FY	Housing Area	Project	Awarded Cost Est. ($000)	Funding Source	Start Quarter	Duration Quarters (MIT/NL)
Compleated							
	92	Algodones Apts	Revitalize 32 units	$t,629	MILCON	*	
	93	Capehart Housing	Repair by Replacement	$t,94t	MILCON	*	
	97	Capehart Housing	Repair Wastewater Collection Systems	$5,375	MILCON	*	
	94	Capehart Housing	Bulk Storage Facility	$1,700	MILCON	*	
	98	Algodones/Caribe Breeze	Site Repairs	$2,093	MILCON	*	
	98	Community Bldg	Repair/Alter Family Hsg		Seabees	*	
	98	Warehouse Bldg	Repair/Alter Family Hsg		Seabees	*	
	98	Housing Welcome Ctr	New Construction	$8t0	MILCON	*	
Under Construction							
t	98	Cascajo Point	Revitalize t39 units/	$1t,t39,987	FHN	-8	10
2	99	Cascajo Point	Burial of Utilities	$t,648,000	FHN	4	4
3	98	Rainbow Hill/ Caribe Breeze	Revitalize 88 units Revitalize 158 units	$23,000	FHN FHN	-8	t0
4	99	Rainbow Hill/Caribe Breeze	Burial of Utilities	$4,708,024	FHN	-4	4
Under Design							
5	0t	Manatee Bay	Revitalize t99 units/				
	01	Caribe Breeze	Revitalize 22 units	$26,665	FHN	4	9
	0t	Manatee Bay	Burial of Utilities	$2,t77	FHN	4	4
Out Years							
	05	Mangrove Manor	Revitalize 275 Units	unknown	FHN	2t	11
	05	Algodones Apts	Revitalize t2 units	unknown	FHN	2t	4
	01	Manatee Bay	Revitalize 69 units/	unknown	FHN	5	4

* Not included in Portfolio

Figure 4-8: NSRR Housing Program CHOICES© Input (Torres and Melendez 2000)

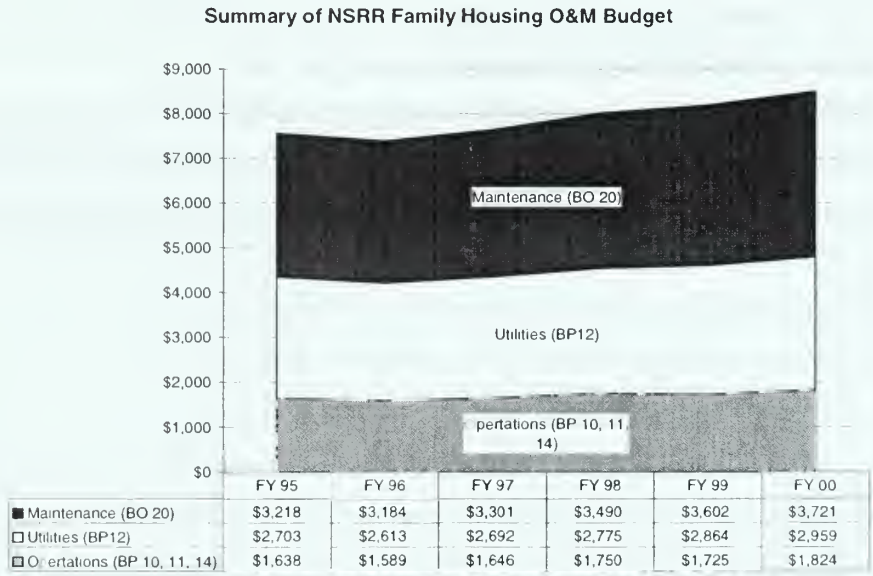


Figure 4-9: NSRR FHN History (Bates 2000)

4.2.2.4 Portfolio Comparison

Aggregate Numerical Comparison

The following table illustrates portfolio differences in NSRR's housing renovations. Major savings in future O&M costs stand to be gained from integrated procurement. Substantial long-term

gains would be maximized with focus on energy efficiency and tropical climate sustainability. Potential savings could be redirected within the communities to provide public amenities cut from the CNP.

Puerto Rico Comparison

	DBB	DB	DBO
Revenues			
P0 Revenues	367,916	367,916	367,916
MHPI	0	0	8,632
MILCON	2,363	2,118	2,118
FHN	73,869	66,510	8,325
PVT EQUITY	0	0	47,462
New Resources	162,594	137,132	22,539
User Fees	0	0	92,840
Subtotal revenues	76,232	68,628	159,376
Expenses			
P0 Expenses	368,379	368,379	368,379
PO Adjustments	-462	-462	-462
Capit Prgm Viab Advert	851	850	856
Permit'g Compet(s) Design	4,631	4,207	4,937
Construction	70,750	63,571	60,756
M&O	162,594	137,132	114,763
Total Costs with Debt Service	238,826	205,760	181,312

Figure 4-10: Roosevelt Roads Aggregate Cost Comparison

Design Bid Build (Existing Portfolio)

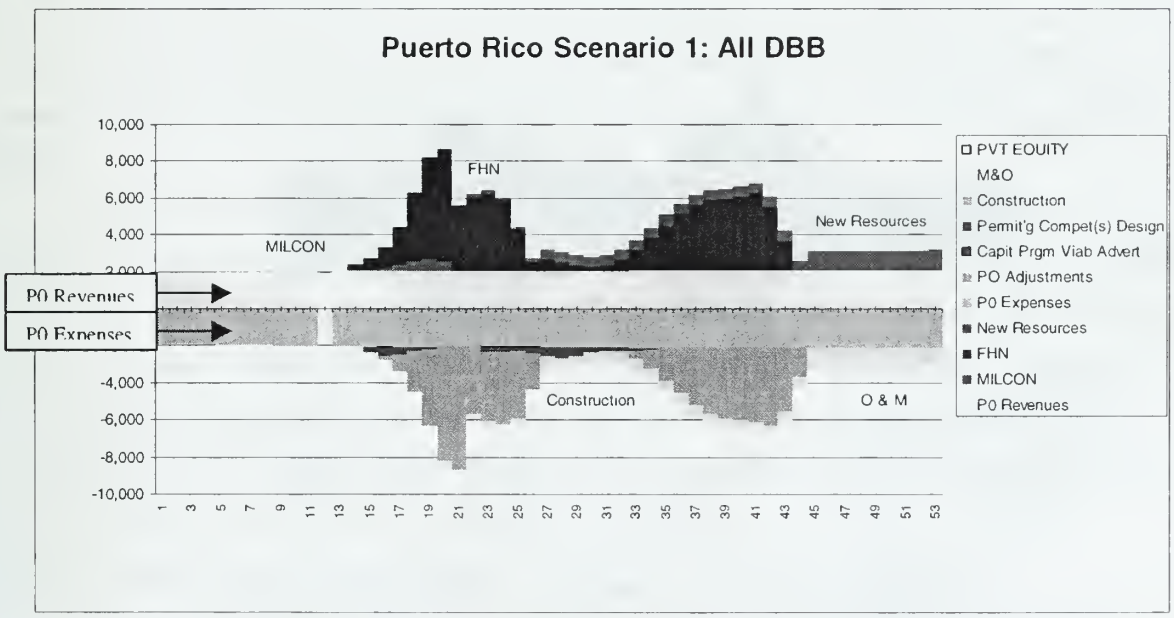


Figure 4-11: NSRR DBB Scenario

Although MILCON was listed as the primary funding source in Figure 4-8, FHN funding is assumed to be used in most cases as projects consist of renovations to existing stock vice new construction. Some MILCON is present in this model from placing utilities underground which could be

construed as new construction in Department of Defense terms. This DBB Scenario is most representative of probable execution in Puerto Rico.

DBB v. DBO Comparison

In a third scenario[41], the larger projects were configured for DBO and those under 100 units were left as DB. Potentially all these could be packaged in a single group and run under a DBO. One particular aspect that may fit well in the DBO scenario is the burial of power lines. The Navy would probably have to supplement initial development costs because of the poor current condition of the power grid. However, potential savings from metering a currently un-metered, "open tap" system could produce significant energy awareness and savings. Since housing occupants are not currently charged for utilities, some sort of incentive system would have to be devised. This may be more feasible when scaled to the base level.

The comparison generated below in Figure 4-12, shows the baseline DBB execution as background compared to the solid lines representing the DBO Scenario. Again, only the revenue side is altered with the funding line representing the Navy's portion of revenue required.

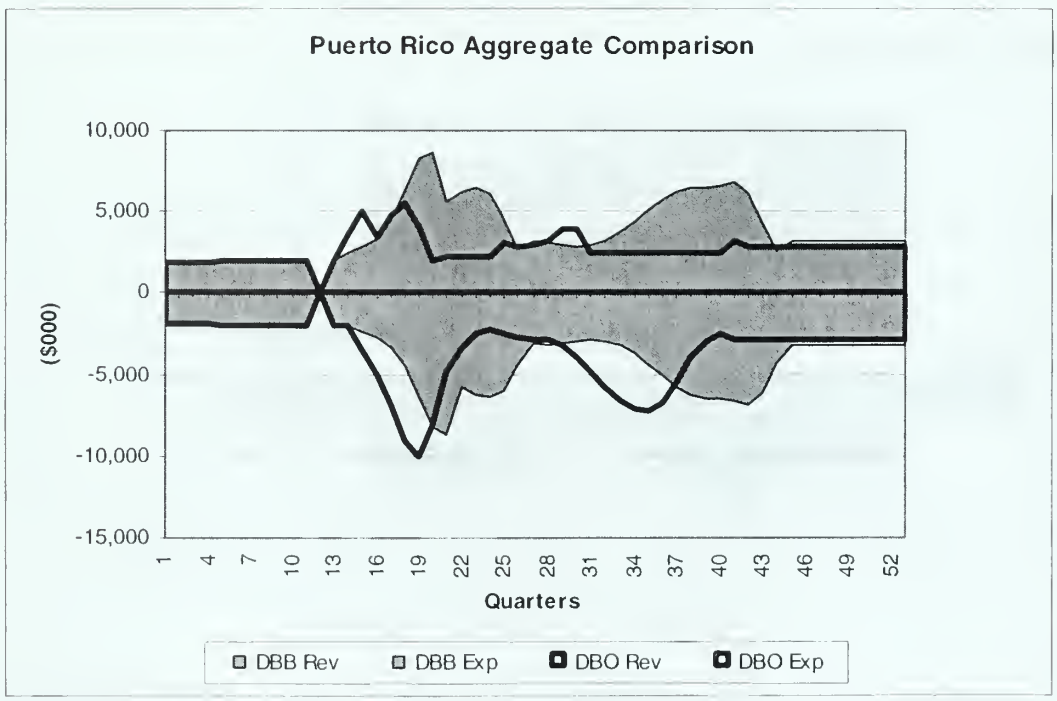


Figure 4-12: Aggregate Comparison of Roosevelt Roads DBB v. Integrated Cash Flows

[41] The second scenario (DB) is not shown because is not likely to be employed.

4.3 Design Build

4.3.1 Ventura, California

4.3.1.1 Regional Background

Ventura County, California is home to both Port Hueneme Construction Battalion Center (CBC) and Point Mugu Naval Weapons Test and Evaluations Command. This year, the commands were combined to form the Ventura Naval Complex. This new command combines housing communities in Point Mugu, Port Hueneme and Camarillo into a single portfolio.

Currently most of the communities on CBC are under renovation. This is a familiar scene on bases as Quality of Life housing money is flowing more freely than other funding streams. Port Hueneme is home to four Naval Construction Battalions, the Naval Facilities Engineering Service Center and the Civil Engineer Corps Officer School. Hence it has become a central hub for the Civil Engineer Corps (CEC). With such a concentration of CEC officers, the housing communities have received a generous share of alternative delivery method application.

Port Hueneme was a site for the "801" leasing program that was the predecessor to current PPV structures. The resulting three hundred (300) units of enlisted condominiums make up a large part of their portfolio and O & M costs as can be seen under Leasing in Figure 4-13. Another "801" program was put in place in nearby 29 Palms Marine Corps Training Area which provides a guaranteed rental stream to the contractor for 20 years. This program has since been dormant but remains available for use. (Sweatte 1999)

Currently, several communities onboard CBC are being revitalized using DB contracts. These include whole house renovations to approximately 200 units. A "best value" source selection was used to select a joint venture that included Dillingham Builders. Current contract administration rates contractor quality as "average" and timeliness as "marginal." (Oestereicher 1999) Although specific details were not available on execution and source selection, displacement and relocation of 200 families within existing assets to allow construction was a major obstacle to efficient execution. Future projects will focus on Camarillo and Point Mugu Communities.

4.3.1.2 Market and Political Drivers

Ventura Naval Complex enjoys several conditions that will enable more variety of delivery methods in the future. In addition to the high owner sophistication, recent aggregation of housing communities, and a growing real estate market will have great effect on the future of housing delivery and operations. The recent combination of two housing communities should provide opportunity for economies of scale. Additionally, the Southern California housing market is growing rapidly. Consequently, many large developments are being pursued by very capable contractors. As this growth is

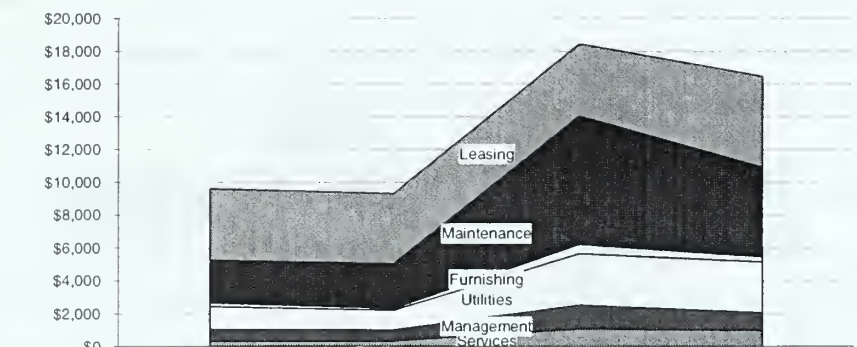
driving costs up, the need for more effective delivery methods combined with the adequate supply of capable contractors should provide ample opportunity to shift Ventura's portfolio to Quadrants I and perhaps II.

4.3.1.3 Specific Modeling Issues

Since most of the CBC renovations are well underway, the funding streams from these projects contain only residual construction and O&M streams. Only three projects are currently planned in the current seven-year planning outlook. Therefore, although it was thought that this complex would provide an interesting perspective on alternative delivery, the applicable data is mostly historic. Nonetheless, the historic use of alternative methods may lead to more prevalent use in the future projects. Thus the integrated portfolio scenario that follows may be reasonable.

The following tables illustrate available information from the Ventura Complex. Leasing will remain the largest portion of the annual housing costs due to the "801" commitment. Note the large increase in costs indicating the merger of assets from Point Mugu and CBC. While O&M costs are now greater than those of New London, the state of the capital planning does not present portfolio options available at New London or other larger concentrations of naval housing.

Summary of Family Housing O&M Budget



	FY 97	FY 98	FY 99	FY 00
Leasing	$4,351	$4,260	$4,394	$5,557
Maintenance	$2,601	$2,742	$7,870	$5,479
Furnishing	$216	$110	$547	$311
Utilities	$1,378	$1,160	$3,109	$3,078
Management	$707	$681	$1,455	$1,067
Services	$360	$353	$1,080	$1,002

Figure 4-13 Ventura FHN History (Kingsley 2000)

Ventura Naval Complex Family Housing Projects by Fiscal Year

Project No.	*FY*	*Housing Area*	*Project*	*Cost Est.*	*Project Start (2nd Qtr of FY)*	*Project Duration (in Qtrs)*	*Funding Source*
1	98	Bruns Park	Whole House Renovation, 130 Units	$8,882	-6	6	FHN
2	98	Bruns Park	Whole House Renovation, 68 Units	$6,431	-6	3	MILCON
3	03	Rosa, Catalina	Whole House Renovation, 111 Units	$9,324	9	5	FHN
4	03	Capehart, Miguel	Whole House Renovation, 106 Units	$8,904	13	5	FHN
5	03	Camarillo	Phase I, 155 Units	$25,719	2	7	FHN

Figure 4-14: Ventura Naval Complex Housing Program CHOICES© Input (Kingsley and Oestereicher 2000)

4.3.1.4 *Portfolio Comparison*

Ventura Comparison

	DBB	DB	DB/DBO
Revenues			
P0 Revenues	495,276	495,276	495,276
MHPI	0	0	8,105
MILCON	0	0	0
FHN	47,755	43,947	18,228
PVT EQUITY	0	0	16,456
New Resources	129,834	120,357	110,273
User Fees	0	0	0
Subtotal revenues	47,755	43,947	42,790
Expenses			
P0 Expenses	491,042	491,042	491,042
PO Adjustments	4,234	4,234	4,234
Capit Prgm Viab Advert	879	879	879
Permit'g Compet(s) Design	3,862	3,515	3,516
Construction	43,015	39,552	38,405
M&O	129,834	120,357	110,262
Total Costs with Debt Service	177,589	164,304	153,062

Figure 4-15: Ventura Complex Aggregate Cost Summary Comparison

Design Build: Current Portfolio

The Ventura Complex was the only base queried that was using DB in their housing delivery. This contrasts with a statistic from 1991 which stated that 77% of NAVFAC housing was delivered by Non-Traditional (DB or Turnkey) methods. (ASCE 1992) Nonetheless, the following scenario in Figure 4-16 represents the most probable path that the Ventura Complex will follow. Certainly within their reach is plan like Scenario 3 in Figure 4-17. A comparison graph was not created because only three projects are planned, however, the comparison was included in the aggregate chart summing all case study scenarios.

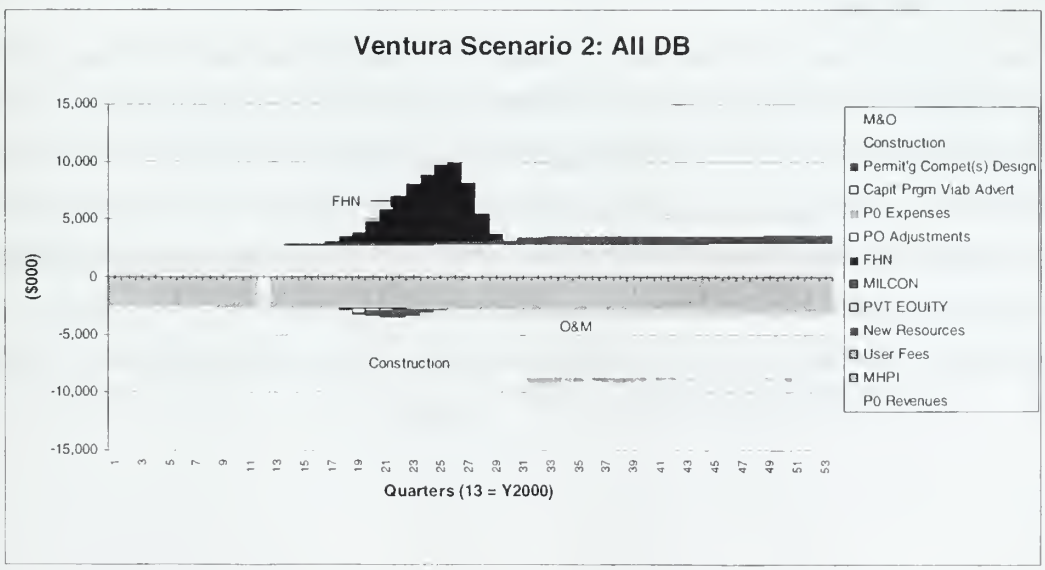


Figure 4-16: Ventura DB Scenario

Integrated Delivery of DB and DBO (Feasible Path)

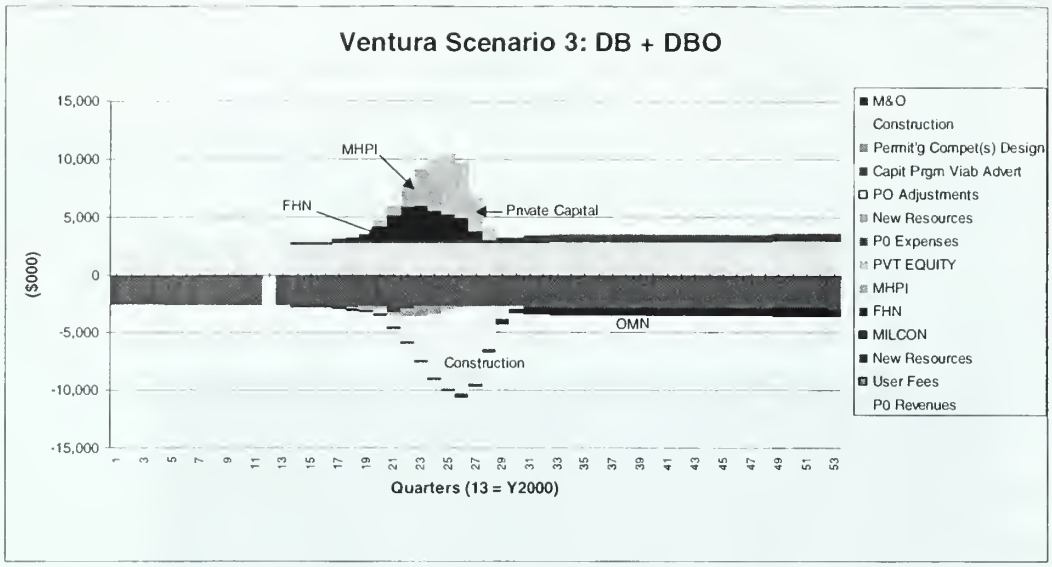


Figure 4-17: Ventura Integrated Delivery

4.4 Design Build Operate: Limited Liability Partnerships (LLPs)

As discussed in Chapter 3, the first Navy Public Private Ventures under the Military Housing Privatization Initiative were started as Limited Liability Partnerships (LLPs) in Washington and Texas. The locations of these first projects were in areas of critical housing deficits, a situation different from most bases, in which housing conditions are poor. Current Navy LLPs are partnerships typically involving 100-300 units on private land with terms of 10 or more years. The private-sector managing partners are allowed to sell the properties upon expiration of the agreement.

4.4.1 Everett, Washington

4.4.1.1 Regional Background

The military population at Everett is approximately 3,149, and there are only 182 military family housing units. Thus only 6% of Everett's families are living in government furnished quarters, the lowest of the queried bases in this thesis. Most of the housing deficit is experienced in the junior enlisted ratings (E1-E6) because there is a shortage of affordable private housing. Market rents have been rising at 5% per year while vacancy has dropped from 5% in 1996, to below 2% currently. (Northwest Division 1999) The table below in Figure 4-18 shows the percentage of salary (where 0.93 = 93%) spent by specific ranks on housing. It is unreasonable for most enlisted personnel to afford housing in this market, thus the PPV efforts.

Affordability Chart	FY 99 RENTAL HOUSING COSTS FOR EVERETT, WA			HOUSING COSTS AS A PERCENT OF TOTAL COMPENSATION								
# BEDROOMS	RENT	UTILITIES	TOTAL HSG COST	E-1	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9
4 BR	$1,385.10	$235.75	$1,620.85	0.93	0.84	0.78	0.70	0.59	0.52	0.46	0.41	0.34
3 BR	$1,231.20	$169.13	$1,400.33	0.80	0.72	0.67	0.60	0.51	0.45	0.40	0.35	0.30
2 BR	$718.20	$113.78	$831.98	0.48	0.43	0.40	0.36	0.30	0.27	0.24	0.21	0.18
1 BR	$666.90	$102.50	$769.40	0.44	0.40	0.37	0.33	0.28	0.25	0.22	0.19	0.16
Base Pay				$887.70	$1,075.80	$1,225.80	$1,428.60	$1,746.30	$2,073.30	$2,382.60	$2,811.30	$3,507.30
BAS ($7.50 per day X 30)				$225.00	$225.00	$225.00	$225.00	$225.00	$225.00	$225.00	$225.00	$225.00
BAH w/Dep.				$631.00	$631.00	$633.00	$661.00	$760.00	$836.00	$919.00	$961.00	$1,014.00
TOTAL COMP				$1,743.70	$1,931.80	$2,083.80	$2,314.60	$2,731.30	$3,134.30	$3,526.60	$3,997.30	$4,746.30
FY MULTIPLIER	1.02	1.03										

If the monthly cost of housing < 35% of Total Compensation: White = Affordable
If the monthly cost of housing is between 36-40% of Total Compensation: Yellow = Caution
If the monthly cost of housing > 40% of Total Compensation: Red = Unaffordable

Figure 4-18: Everett Housing Costs as Percentage of Salary (Calcara 1999)

Everett I: Country Manor

Everett's first Public Private Venture was a 185-unit townhouse complex completed in November of 1997. A Limited Liability Partnership was formed in which the Navy was the Limited Partner and contributed 33% of the equity in cash for development. This was one of the first developments of its kind authorized by the FY 95 Defense Authorization Act. Total development costs were $18.7 million which yielded unit costs of just over $101 thousand. The term was relatively short at ten years. Under the agreement, 20% of the units could be sold annually in years six through ten. The target tenants were E4-E6's via mainly three bedroom units. (Carpenter 1999)

These units are available to military members at $200-$300 below comparable units on the private market. Rent structure is increased annually based on a negotiated Housing CPI. Where military members of lower rank are unable to cover the housing rent and utilities within their BAH allotment, a Differential Lease Payment (DLP) is provided by the Navy to the General Partner. (Nghe 2000)

Everett II

The second LLP venture for Everett is slightly more significant in scope at approximately 300 houses with a maximum Navy equity contribution of $18.9 million. The scope includes land acquisition, design, construction, finance, ownership, operations and maintenance. Variables offered in the two-step source selection include actual number of houses provided and the amount of subsidy required through Differential Lease Payment (DLP). The Navy cash contribution, including the present value of future DLPs, may not exceed $18.9 million (or 33% of development costs).[42] Term length is another proposal variable with a minimum set at 15 years. However, the RFP states that longer terms are preferred, provided more units and higher quality standards are proposed. (Northwest Division 1999)

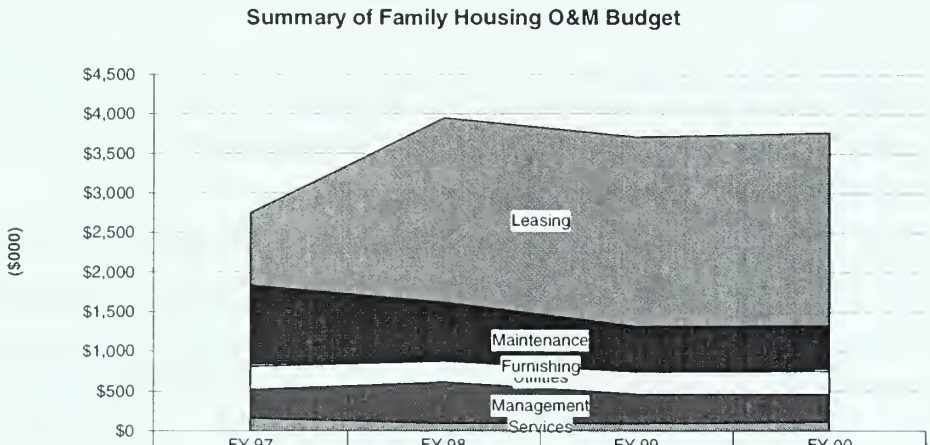
[42] Again, this limit is set by Section 2875 of Title 10 U.S.C. that governs limited partnerships on private land.

4.4.1.2 Market Drivers

The area north of Seattle continues to grow rapidly to meet housing needs generated by Boeing and Mircrosoft growth. Obviously, the Navy could not make its enlisted personnel compete with booming industry employees for housing. This high local demand offered unique opportunities that would benefit public and military populations alike. The LLP structure in Everett allowed the houses to be incrementally sold to the public toward the end of the contract term and rented at market rates to civilians when Navy demand was low during the contract.

4.4.1.3 Specific Modeling Issues

Figure 4-19 depicts the history of the housing budget at Everett. Leasing is a huge portion of their costs and will continue to be until the PPV currently under negotiation is completed. Additional relief will come with a planned MILCON project in FY 03. However, both of these will contribute increased expenses in the form of BAH rent streams or maintenance costs. See the CHOICES© DBO projection in Figure 4-22 below for an approximation.



	FY 97	FY 98	FY 99	FY 00
Leasing	$914	$2,331	$2,390	$2,441
Maintenance	$997	$742	$570	$549
Furnishing	$26	$0	$3	$25
Utilities	$295	$265	$281	$286
Management	$359	$516	$372	$352
Services	$159	$99	$92	$113

Figure 4-19: Everett O&M History (Koerber 2000)

Everett Family Housing Projects by Fiscal Year

Project No.	*FY*	*Housing Area*	*Project*	*Cost Est.*	*Project Start (2nd Qtr of FY)*	*Project Duration (in Qtrs)*	*Funding Source*
1	00	Everett PPV II	300+ Units on Private Land	$57,000	*1*	*8*	MHPI
2	00	Brier	12 currently unfunded	$840	*3*	*3*	FHN
3	01	Fort Lawton	66 currently unfunded	$4,765	5	3	FHN
4	03	Everett	Construct new, 125	$22,062	13	5	MILCON

Figure 4-20: Everett Program CHOICES© Input (Northwest Division 1999 and Koerber 2000)

4.4.1.4 *Portfolio Comparison*

Aggregate Numerical Comparison

The integrated portfolio scenario for Everett is very close to reality and provides some perspective on the life cycle advantages offered by these ventures. This portfolio assumes that the proposed MILCON project in Fiscal Year (FY) 03 will be executed by DBO. But, inadequate PPV "seed" funding of $17.4 million for FY 03, may preclude DBO. (Shelton 2000)

Everett Comparison

	DBB	DB	DBO
Revenues			
P0 Revenues	157,967	157,967	157,967
MHPI	0	17,869	24,822
MILCON	80,031	22,104	42
FHN	6,222	4,765	4,765
PVT EQUITY	0	18,263	32,380
New Resources	207,783	64,421	20,803
User Fees	0	94,689	129,547
Subtotal revenues	83,986	149,717	183,582
Expenses			
P0 Expenses	145,962	145,962	145,962
PO Adjustments	12,005	12,005	12,005
Capit Prgm Viab Advert	553	553	553
Permit'g Compet(s) Design	2,704	2,323	2,323
Construction	82,994	60,356	59,372
M&O	205,516	150,339	141,349
Total Costs with Debt Service	291,768	213,571	203,597

Figure 4-21: Everett Cost Summary Comparison

Integrated Portfolio

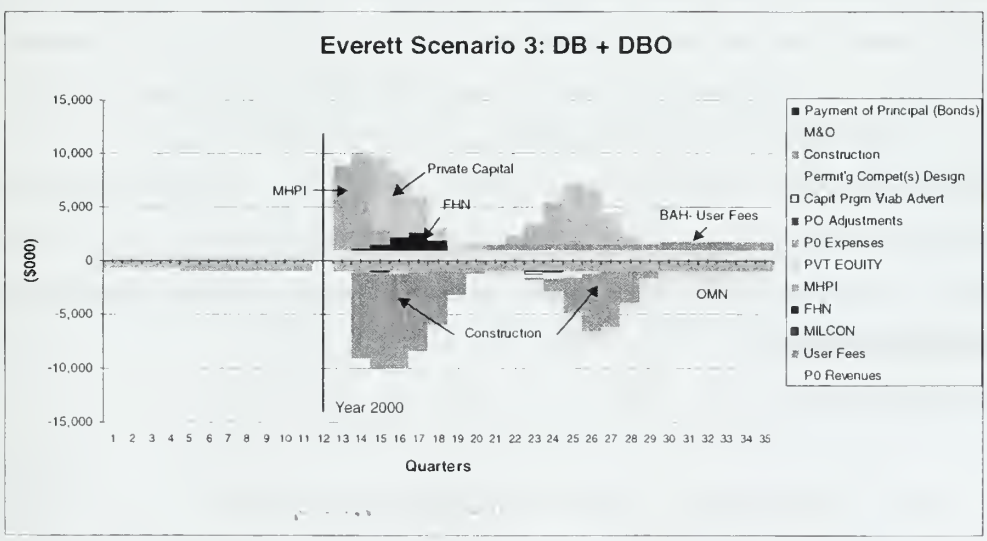


Figure 4-22: Everett Integrated Portfolio

Aggregate Portfolio Comparison

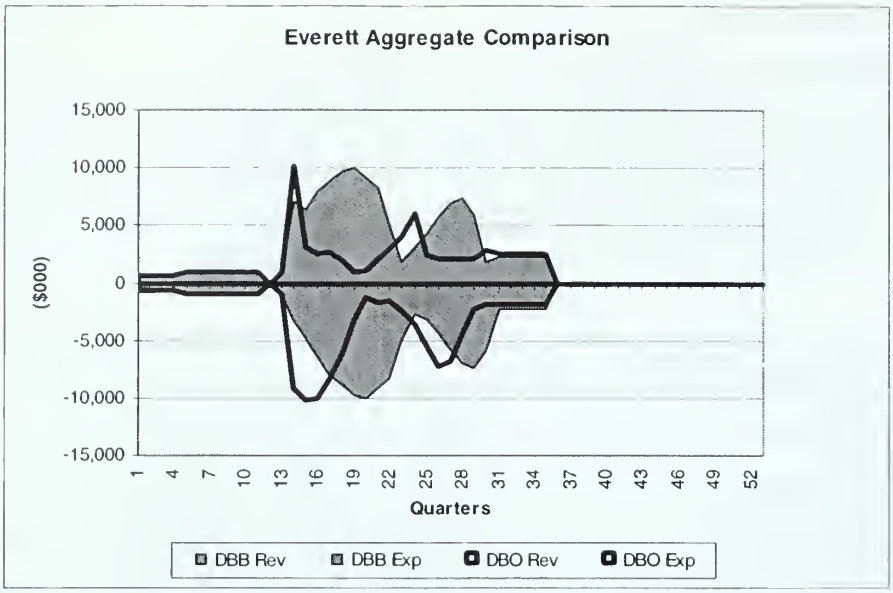


Figure 4-23: Everett Aggregate Portfolio Comparison

4.4.2 South Texas (Mix of LLP and LLC)

NAVFAC's Southern Division used PPV most extensively to date. Five separate projects are now in progress at: Kingsville, Texas, Corpus Christi and Ingleside, Texas; New Orleans, Louisiana; Albany Georgia; Beaufort and Parris Island, South Carolina. In total, Southern Division is acquiring 2,525 units through conveyance, renovation, and new construction. South Texas represents 38% of this total, placing 960 units under Limited Liability Partnerships and Corporations. Upon completion of both the Kingsville and Corpus-Ingleside communities, the entire housing stock will be delivered through PPVs. Driving forces behind these ventures are significant deficits at each base and viable financial forecasts. These new PPV efforts will bring the current housing deficit projections for FY 04 close to zero.

The Corpus Christi and Ingleside bases are home to approximately 6,300 personnel. Of the 4,100 families present, approximately 64% are housed in the local community. Private rental vacancies are fairly low at under 5%. Market rents often exceed military allowances, particularly among junior enlisted pay grades. (Southern Division 1999)

4.4.2.1 Regional Background

South Texas I

The Navy's first LLP ventures were commissioned at Kingsville and Portland, Texas in May of 1997. The Communities offered 102 and 302 units respectively. Total development costs were $27.5 million, or $68 thousand per unit. The term length was ten years with an option to extend another five years.

As the first LLP agreements to be initiated by NAVFAC, numerous lessons were learned, which the Navy attempted to describe for future projects in a standardized PPV manual. Both communities had significant occupancy problems upon initial opening. Initially, Navy occupancy rates in the Kingsville and Portland PPV communities were 38% and 76% respectively. Since the agreement gave the Navy "first right of refusal," lack of available or interested Navy tenants allowed rental of the remaining units to civilians.

This low occupancy rate seems abysmal for an area where a dire housing deficit was the basis for the projects. However, numerous timing and market issues were at play. First, the units were offered to military personnel without a differential lease payment and proved to be too expensive for the target families at set rental rates. Next, it took over a eighteen months to put an effective Differential Lease Payment (DLP) program in place. Additionally, the projects were completed at the end of the fiscal year when many families were transferring out, but none were transferring in due to a lack of Permanent Change of Station funding.

Now, over two thirds of the Portland rates are now significantly subsidized with DLP. This shows how the Navy's housing allotments were not aligned well with the financial structure of the projects. Newer agreements build rental rate structures, rate increase indexes and DLP subsidy into the solicitations and final contracts. (Dowgiewicz and Miller, M. 2000)

South Texas II

There are actually two separate solicitations involving three bases in Texas. The first contract is to build 150 new units on private land near Kingsville. The government is fronting the standard 33.3% of development equity in cash for this $14.5 million contract. The term required is 15 years with potential for a 15-year option. (Miller, M. 2000)

The second solicitation involves providing 810 units for bases at Corpus Christi and Ingleside. This will be a conglomeration of an Limited Liability Partnership (LLP) and a Limited Liability Corporation (LLC). The Corpus Christi agreement will be an LLC for 50 years as it involves conveyance of 537 existing units to include renovations and up to 129 new or replaced units on Navy land. One unique aspect of the project includes restoration of 14 historic units which one may find unusual for a DBO project. The Ingleside portion of the agreement will provide for construction of 200 new units on private land. This agreement spans 20 years and no government real property is involved. (Southern Division 1999)

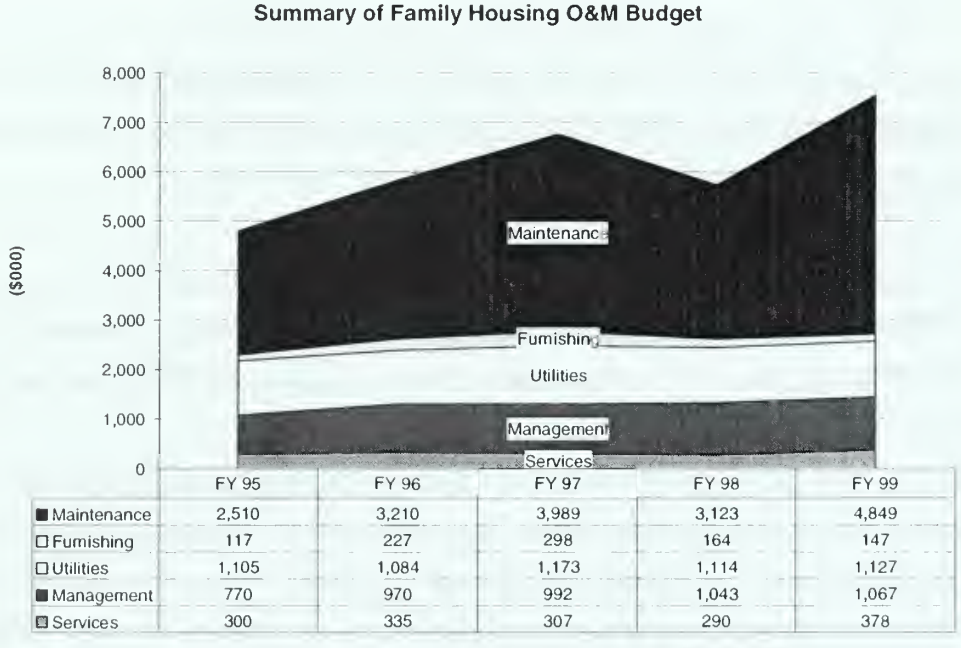
4.4.2.2 Market Drivers

Texas' local housing conditions were stable in relation to Everett's booming real estate market. Land and construction costs were cheap relative to east and west coast centers of naval concentration. Both Washington and Everett areas had adequate contractor interest and level of expertise to execute such

contracts at the relatively smaller package size. Follow-on LLPs are larger and may invite larger national firms. Additionally, projects in both areas were not viable without institution of a Differential Lease Payment (DLP) system. Military Basic Housing Allowance is structured at only 80% of average rental rates. The Navy could not account for this difference through 33% equity contribution alone. Unfortunately for the first projects, DLP subsidy was not part of the initial negotiations and rents were too high for the target Navy occupants. As a result, subsidy requirements are now a standard consideration in proposal reviews.

4.4.2.3 Specific Modeling Issues

All Texas housing projects are PPV agreements. These aggregations of communities were modeled in both DBO and segregated procurements as packaged in the solicitations. Individual projects that make up the PPVs packages within both Kingsville and Ingleside were also broken down for comparison when executed at different time frames. Figure 4-28 depicts their comparison.



	FY 95	FY 96	FY 97	FY 98	FY 99
Maintenance	2,510	3,210	3,989	3,123	4,849
Furnishing	117	227	298	164	147
Utilities	1,105	1,084	1,173	1,114	1,127
Management	770	970	992	1,043	1,067
Services	300	335	307	290	378

Figure 4-24:South Texas Combined O&M History (Sepe 2000)

South Texas Family Housing Projects by Fiscal Year

Project No.	*FY*	*Housing Area*	*Project*	*Cost Est.*	*Project Start (2nd Qtr of FY)*	*Project Duration (in Qtrs)*	*Funding Source*
1	1	Corpus Christi and Ingleside	PPV II, 810 End state units	$56,300	6	10	MHPI
2	O1	Laguna Shores	100 Units Completed	deleted			
3	O1	Laguna Shores 2	129 Units within PPV II	$11,675	6	5	FHN
4	O2	Laguna Shores 3	200 Units within PPV II	$20,591	10	8	FHN
5	O1	FY 66 1	100 Units within PPV II	$7,990	6	4	FHN
6	O2	FY 66 2	150 Units within PPV II	$11,500	10	6	FHN
7	O3	FY 66 3	116 Units with PPV II	$9,998	16	5	FHN
8	OO	Kingsvile	PPV II, 150 New units	$14,500	4	6	MHPI

Figure 4-25: South Texas Program CHOICES© Input (Southern Division 1999 and M. Miller 2000)

Projects 2-7 in Figure 4-25 represent the individual projects that make up the Corpus Christi PPV solicitation. DBB scenarios were generated using the combination of these projects within one PPV package and also as individual projects.

4.4.2.4 Portfolio Comparison

Aggregate Numerical Comparison

South Texas Comparison

	DBB Individual	DBB Group (PPV)	DBO (PPV)
Revenues			
P0 Revenues	468,485	468,485	468,485
MHPI	0	0	19,714
MILCON	35,602	73,081	0
FHN	32,732	0	0
PVT EQUITY	0	0	43,811
New Resources	147,510	134,493	24,216
User Fees	0	35,887	90,643
Subtotal revenues	68,334	108,968	154,168
Expenses			
P0 Expenses	546,010	546,010	546,010
PO Adjustments	-77,525	-77,525	-77,525
Capit Prgm Viab Advert	1,086	0	1
Permit'g Compet(s) Design	5,494	2,323	3,692
Construction	61,754	70,757	59,270
M&O	147,510	170,163	114,858
Total Costs with Debt Service	215,844	243,244	177,821

Figure 4-26: South Texas Cost Summary Comparison

Integrated Delivery Portfolio (Actual)

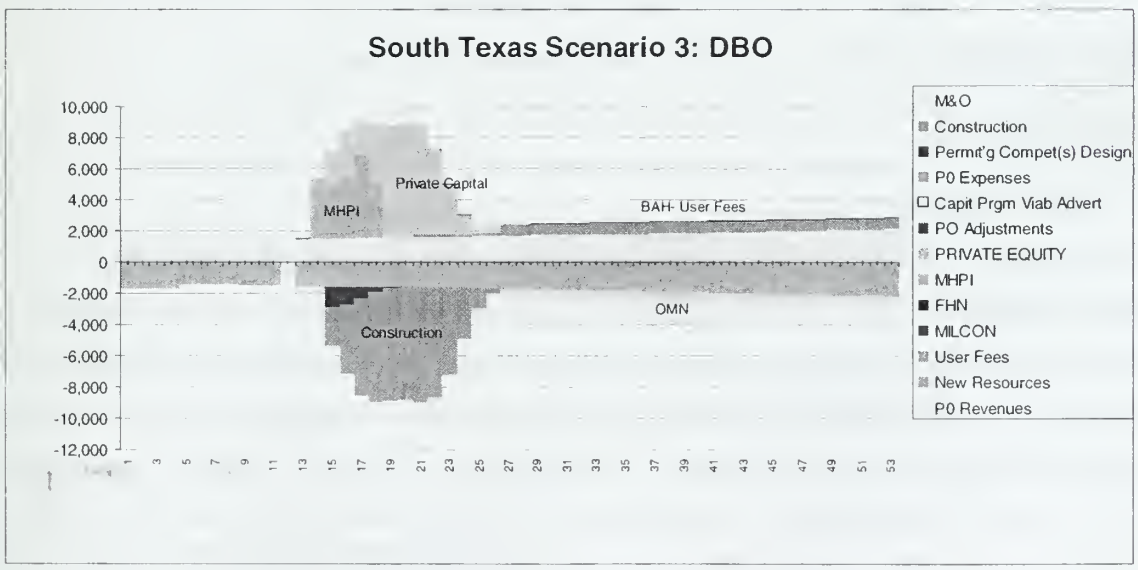


Figure 4-27: South Texas Integrated Scenario

Aggregate Comparison of Portfolios

The following figure compares the PPV solicitation cash flows for both their original DBO format and a DBB portfolio of the same scope. The opaque background represents the portfolio when executed as individual projects in consecutive years. The dotted line represents the execution of the PPV contract package via DBB in lieu of DBO. Finally, the solid lines represent execution of the PPV as a DBO as actually planned. This shows the significant advantages of exploring pace, which can produce time and dollar savings via integrated acquisition of a group of projects as a whole over execution of individual projects by DBB delivery.

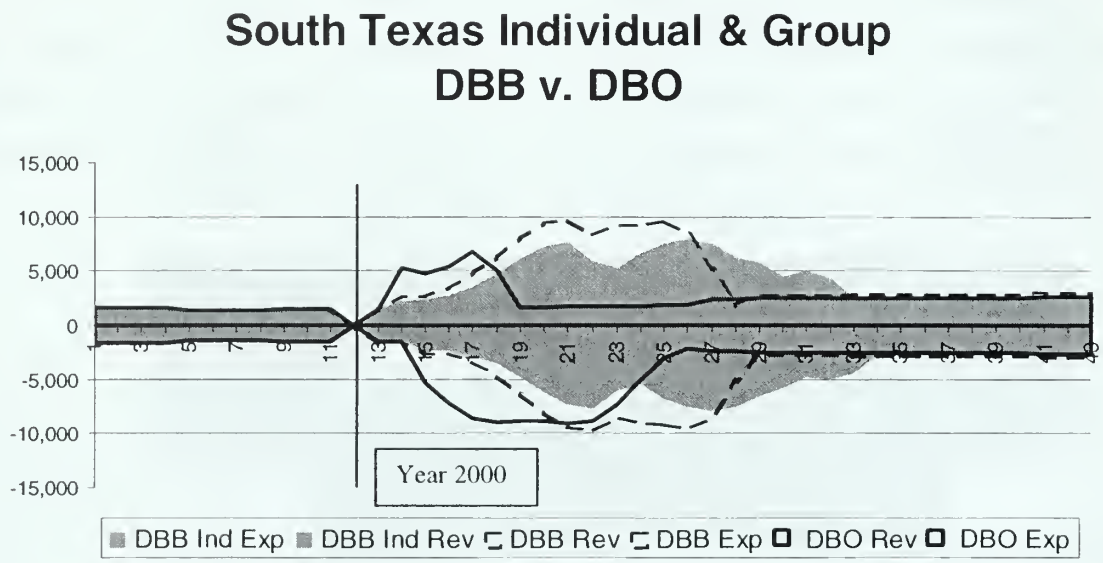


Figure 4-28: Aggregate Comparison of South Texas Portfolios

4.5 Design Build Operate: Limited Liability Corporation (LLC)

4.5.1 San Diego, CA

4.5.1.1 Regional Background

Naval Complex San Diego (NCSD) consists of eight Navy and Marine Corps installations supporting air, surface and sub-surface units. As the west-coast Navy concentration area, it is home to over 57,000 personnel and 33,000 families. This population of families is projected to grow by 4,000 over the next five years. (Southwest Division 1999) With a current family housing inventory of approximately 8,500, only one quarter of the families can be housed in government quarters.

This poses significant problems in San Diego's expensive and "tight" real estate market, where private family housing vacancy rates are quoted as low as 1.2%. (U. S. Census Bureau 1999) Low vacancy also serves to drive housing costs well beyond the many servicemen's Basic Allowance for

Housing. Junior enlisted families not in Navy family housing are forced to spend out of pocket for both rent and utilities.

NCSD's housing communities are distributed throughout both bases and local neighborhoods. Starting in 1999, personnel were allowed to occupy government housing on any NCSD base or community regardless of where they are stationed. While this may alleviate some balance issues, the high demand for government quarters will remain unanswered. Hence the need for an increased focus on alternative finance and delivery methods to provide more units.

4.5.1.2 Delivery Package Drivers

Project Drivers

The following discussion relates to the San Diego LLC venture, however, many of the issues are common to all PPV efforts. Each paragraph relates to a specific owner requirement within the Project Driver Matrix that follows.

Time Constraints: Although the Navy is expediently trying to rectify the disrepair of their overall housing inventory, they have not indicated a time-constrained situation for this particular project. Inherently, the choice of DBO will encompass schedule efficiencies of an integrated system. Renovation of currently occupied homes while meeting pressing Navy housing needs will present challenging time constraints, so a more flexible contract structure is needed. A typical DBB contract addressing the same circumstances would be rife with delay and change order potential. Fast tracking (design and construction overlap) is definitely desired. However, the Navy's tendency toward controlled approval processes may impede system efficiency if they also wish to approve the final design before allowing construction to proceed.

Flexibility Needs: The scope of the project is defined in a mix between performance and detailed trade specifications. The number, location, sizing, and quality of housing units are well-defined which should eliminate any need for heavy owner involvement. This type of specification is a step in the right direction as the Armed Services transition from their heavily laden specifications standards.

Pre-Construction Needs: Pre-construction services entail cost estimation, constructability and value engineering issues. The Navy demonstrates significant capacity in these areas via their network of NAVFAC staffing. The project entails typical housing stock, so constructability issues involved should be minimal. Value Engineering ideas will be in full control of the General Partner and will directly affect their financial performance. This is also an improvement as typical Value Engineering policy effects mainly construction phases. Through integrated procurement, planners, designers and operators can act early when their actions carry significant impact.

Design Process Interaction: The Navy should not require a high level of design interaction because they have developed "performance" specifications. If a highly specialized facility instead of multi-family housing units were being designed, more interface may be required.

Financial Constraints: The primary driver for PPV development was the lack of financial resources. LLP and LLC ventures are designed to leverage private capital to quickly acquire greater amounts of housing. Hopefully, these methods will become optional in the future instead of directive in nature where one method is again "pre-determined."

The figure below summarizes the evaluation of the Project Drivers. The checks in the first column indicate the needed elements for the San Diego LLC project. Based on the identified needs of the project, BOT (actually DBO) is identified as the only acceptable delivery method.

Drivers	PPV	GC-FP	GC-R	CM	MP	DB-FP	DB-R	T-FP	T-R	BOT
Fastrack Schedule	✓		√	√	√	√	√	√	√	√
Sequential Schedule		√	√	√	√	√	√	√	√	√
More Flexibility			√	√	√		√		√	
Less Flexibility	√	√	√	√	√	√	√	√	√	√
PreConst. Advice Reqd			√	√		√	√	√	√	√
No PreConst. Advise Reqd	√	√	√	√	√	√	√	√	√	√
Design Interaction		√	√	√	√		√		√	
Less Design Interaction	√	√	√	√	√	√	√	√	√	√
Const. Financing Reqd	√							√	√	√
Permanent Financing Reqd	√									√
Owner Financing		√	√	√	√	√	√			

Figure 4-29 San Diego Project Driver vs. Organization Matrix

Market Drivers

The following paragraphs pertain to the San Diego LLC:

Availability of Appropriate Contractors: The housing contractor market in the San Diego area is robust. During the initial pre-proposal conference and site visit, there were over one hundred thirty attendees. Aside from the government officials, the list still contained numerous financial, construction, operating, and developing firms. Some of the more prominent names were Arthur Anderson, Bovis, CENTEX, Gateway, Hunt, JA Jones, Legacy, SAIC, and Tramwell Crow Residential. (Southwest Division 1999b) As the selection process is currently in progress the names of the final four qualifiers selected is not yet public information. (Megliola 2000)

Current State of the Market: The vacancy rates for the housing market are currently very low in San Diego, with the homeowner vacancy rate at 1.2% and rental vacancy rates at 4.2% (U.S. Census Bureau 1999). Furthermore, the average market rental rates can exceed the Navy rent allowance (BAH) by as much as 60%. Private developers may have more incentive to pursue private developments that

allow capture of higher market rental rates in lieu of the lower rate structure in this LLC. However, two attractive aspects of the LLC are the 1) low availability and high cost of prime development land and 2) the steady, long-term cash flow from a reliable source.

Package Size: The San Diego LLC is a large project. However, in relation to current California developments of up to 70,000 houses, this is certainly a manageable package under one contract. The Navy's already covers operations and maintenance of entire housing portfolios under single contracts. This agreement adds development and revitalizations into that realm.

Influence of Market Drivers: The market is right in this region for such an agreement. The high attractiveness of San Diego's real estate market and lifestyle combined with a relatively predictable Naval presence for years to come, will make this and similar agreements viable.

Risk Analysis and Award Method

A Risk Allocation and Management matrix for San Diego is presented below in Figure 4-30. This type of analysis is prevalent in all integrated delivery configurations as presented in numerous case studies in Professor John Miller's Infrastructure Development course at M.I.T.[43] Additionally, the source selection process, a three-step, RFQ-RFP-Negotiation method used in San Diego is standard among current PPV efforts.

[43] A very thorough risk analysis is available in the Tolt River Water Treatment Case, a model of integrated delivery success. (ISDR 1998)

Risk	Allocation	Comments
Permitting	Contractor (primary)/ NAVY	-The NAVY has prepared the environment documentation in satisfaction of its affirmative responsibilities under the National Environmental Policy Act (NEPA). Although the contractor does not have to compose another one, they are expected to follow that of the NAVY. -The contractor is responsible for local regulatory approvals, and completion of any planning, zoning, and/or permitting required prior to construction. -The NAVY will be providing the contractor with a Data Pack of the project, which will furnish information of each site. This includes current Davis-Bacon wage decisions, NEPA documents, Environmental Baseline Studies, title reports, and utility and street ownership.
Design	Contractor (primary)/ NAVY	-The main risks involved in design remain with the contractor. -The NAVY did provide a minimum guideline requirements for the designs. If the guidelines were to be inadequate, then the responsibility would be that of the NAVY.
Construction	Contractor	-The contractor is responsible for all construction and demolition risks. This includes scheduling, labor, materials, and management of the construction.
Operation & Maintenance	Contractor (primarily)/NAVY	-The contractor takes the risk in case of O & M escalation. The NAVY, nonetheless, guarantees to adjust the rental rates annually according to BAH. A specific formula to adjust rental rates will be mutually agreed upon during the negotiation stage. -If BAH increase lags escalation in O&M expenses, the Contractor may be allowed to rent a percentage of units to civilians at market prices. -Major uncertainty for the contractor lies in the potential of base closure which results in reduced/no demand for housing by the NAVY, whereby the contractor remains responsible for debt service, but the Navy still shares in the profits for housing units successfully rented to civilians at market prices.
Financing	Contractor/NAVY	The contribution of $20.9 million by the NAVY can be used to fund up-front development expenses. The contractor would assume other financing risks including interest rate fluctuation (if floating instead of a fixed rate) of the construction loan and the permanent loan. This represents a fair allocation of risks between the two parties since: (i) Typically the highest risk level lies with the construction period, and the availability of $20.9 million in this initial period adds flexibility in managing risk. (ii) Risk level decreases substantially upon completion, and the contractor, having full control of the site, is in a better position to fully assume the risk.

Figure 4-30: Risk Assessment, Allocation, and Management Comments for the San Diego DBO Housing Project

4.5.1.3 Specific Modeling Issues

Scope

The Navy will turn over 2660 existing houses to the General Partner in the San Diego agreement. These houses will be renovated or replaced over the next five years based upon a predetermined schedule

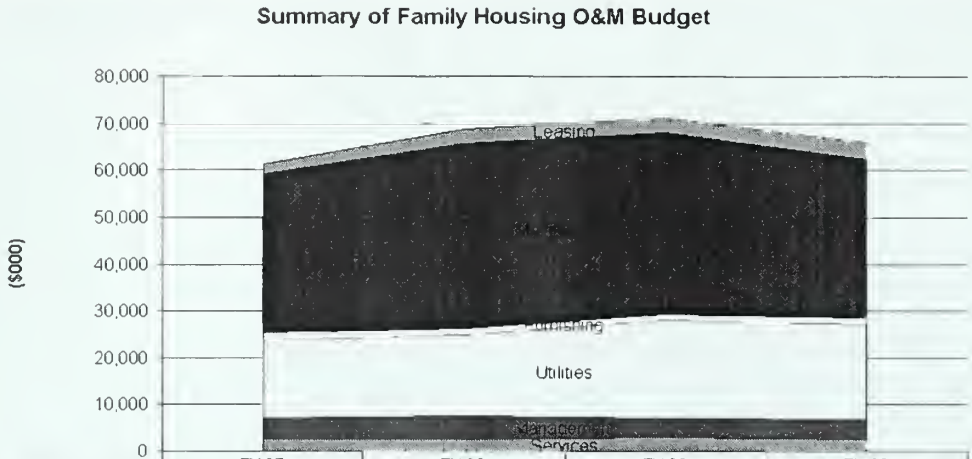
and estimate. All conveyed and newly constructed houses will be under a 50-year agreement that requires two major revitalizations, operations and maintenance. The total project development cost is estimated at $151 million with the Navy providing $21 million in cash assets. By law, the total Navy development equity in the form of land, existing houses, utilities and cash cannot exceed 45% of the total development costs. The contract scope reads as follows:

- Operate manage and maintain some of the existing inventory of DON-owned family housing (2,660 units) and any additional units constructed, including site infrastructure, for a term of 50 years.
- Design, finance and construct needed renovations to existing inventory.
- Design, finance, demolish and replace 812 units of existing inventory on DON-provided land (Cabrillo site).
- Design, finance, and construct 588 new units on DON-provided land (500 units at Naval Training Center and 88 units at the Cabrillo site).
- Recapitalize five percent of the units in years 11-30 at an average cost per house of $20 thousand in 1999 terms inflated at 3% per year. Repeat this cycle for years 31-50 at an average 1999 dollar cost of $40 thousand per unit. (Southwest Division 1999a)

Relative to typical military contracts, the scale of this venture is very large in terms of contract integration, units involved, and time. Typical Navy Design-Bid-Build projects are executed at the community level of 100-200 houses with total project cost in the $10-20 million range. The San Diego contract will entail design, construction, rehabilitation, finance, operations and maintenance for 20 communities ranging from 24 to 812 units.

O & M History

The following chart shows the O & M history for the San Diego Complex. Projections for the largest funding categories, Maintenance and Utilities, are projected to decrease by approximately 25% over the next three years as the LLC divests the 2600 units from the Navy's FHN budget books. Without a specific benchmark on the current communities being conveyed, it will be difficult to tell whether maintenance and utility costs are actually decreased when paid for through Basic Allowance for Housing and Differential Lease Payment funding streams. The assumption is that the life cycle approach and profit incentive for the General Partner will cause these savings to occur. Specific accountability for utilities will now be in place per individual housing unit where none existed before. Also, now that maintenance costs will directly affect profit margins, there will be powerful incentives for the General Partner to design, operate and establish policies that minimize these costs. Since maintenance costs far outweigh any other post-development costs, certainly the LLC will be centered on a focused, maintenance cost reduction strategy. The length of this agreement offers a unique opportunity to optimize maintenance costs.



	FY 97	FY 98	FY 99	FY 00
Leasing	1,999	3,093	3,246	3,556
Maintenance	33,807	39,281	38,528	33,856
Furnishing	1,765	1,624	1,331	1,292
Utilities	16,588	17,339	21,130	20,431
Management	4,565	4,756	3,824	4,139
Services	2,506	2,668	3,118	2,691

Figure 4-31: San Diego O&M History (Simpson 2000a)

Capital Improvements Program

The following array of projects was entered into CHOICES© software to model projected cash flows based on plans through Fiscal Year 2007. They have a steady revitalization/renovation program followed by considerable volume of new construction in the latter years of the seven-year projection. Apparently the most pressing concern is the addressing the current quality of existing housing and not the number of units available.

San Diego Family Housing Projects by Fiscal Year

Project No.	*FY*	*Housing Area*	*Project, units*	*Cost Estimate ($000)*	*Project Start (2nd Qtr of FY)*	*Project Duration (in Qtrs)*	*Funding Source*
1	*00*	*LLC*	*20 Communities, 2600*	*150,000*	*05*	*12*	*MHPI*
2	*98*	*Chollas*	*Historic Renovation, 7*	*1,247*	*-8*	*7*	*FHN*
3	*98*	*Murphy Canyon II*	*162*	*9,547*	*-8*	*12*	*FHN*
4	*99*	*Murphy Canyon III*	*326*	*24,726*	*-4*	*12*	*FHN*
5	*99*	*Hartman IV*	*58*	*4,851*	*-4*	*3*	*FHN*
6	*00*	*Sub Base*	*Historic Renovation, 8*	*2,990*	*0*	*4*	*MILCON*
7	*01*	*Murhpy Canyon IV*	*347*	*27,123*	*5*	*12*	*FHN*
8	*02*	*Murphy Canyon V*	*340*	*27,778*	*9*	*12*	*FHN*
9	*02*	*Hartman V*	*78*	*6,445*	*9*	*3*	*FHN*
10	*03*	*Murphy Canyon VI*	*334*	*27,288*	*9*	*12*	*FHN*
11	*04*	*Murphy Canyon VII*	*338*	*27,716*	*13*	*12*	*FHN*
12	*05*	*Miramar*	*77*	*6,065*	*13*	*3*	*FHN*
13	*05*	*Gateway*	*276*	*21,725*	*17*	*9*	*FHN*
14	*05*	*Gateway*	*269*	*22,888*	*21*	*9*	*FHN*
15	*05*	*New MCON*	*200*	*32,681*	*21*	*6*	*MILCON*
16	*05*	*New MCON*	*300*	*48,017*	*21*	*6*	*MILCON*
17	*05*	*New MCON*	*300*	*48,517*	*21*	*8*	*MILCON*
18	*05*	*New MCON*	*150*	*25,757*	*21*	*6*	*MILCON*
19	*06*	*New MCON*	*250*	*44,549*	*25*	*7*	*MILCON*
20	*06*	*New MCON*	*300*	*49,536*	*25*	*8*	*MILCON*

Figure 4-32: San Diego Program CHOICES© Input (Simpson 2000b)

4.5.1.4 *Portfolio Comparison*

Aggregate Numerical Comparison

The following table illustrates potential savings of over one quarter the current costs with DBB approaches, when choosing an integrated approach to delivery. It enormously reduces initial capital costs which reduces the amount of capital leveraged in higher risk construction phases and maximizes life cycles cost savings.

San Diego Comparison

	DBB	DB	DBO
Revenues			
P0 Revenues	3,240,791	3,240,791	3,240,791
MHPI	0	21,631	123,372
MILCON	432,278	250,554	1,498
FHN	205,763	187,132	35,270
PVT EQUITY	0	117,579	399,633
New Resources	1,374,853	870,013	120,071
User Fees	0	243,110	846,596
Subtotal revenues	637,674	820,007	1,406,370
Expenses			
P0 Expenses	3,719,881	3,719,881	3,719,881
PO Adjustments	-479,090	-479,090	-479,090
Capit Prgm Viab Advert	7,224	7,224	7,539
Permit'g Compet(s) Design	38,167	40,202	41,274
Construction	592,248	526,968	508,794
M&O	1,374,888	1,114,116	963,288
Total Costs with Debt Service	2,012,527	1,688,509	1,520,895

Figure 4-33: San Diego Cost Summary Comparison

Integrated Delivery Portfolio

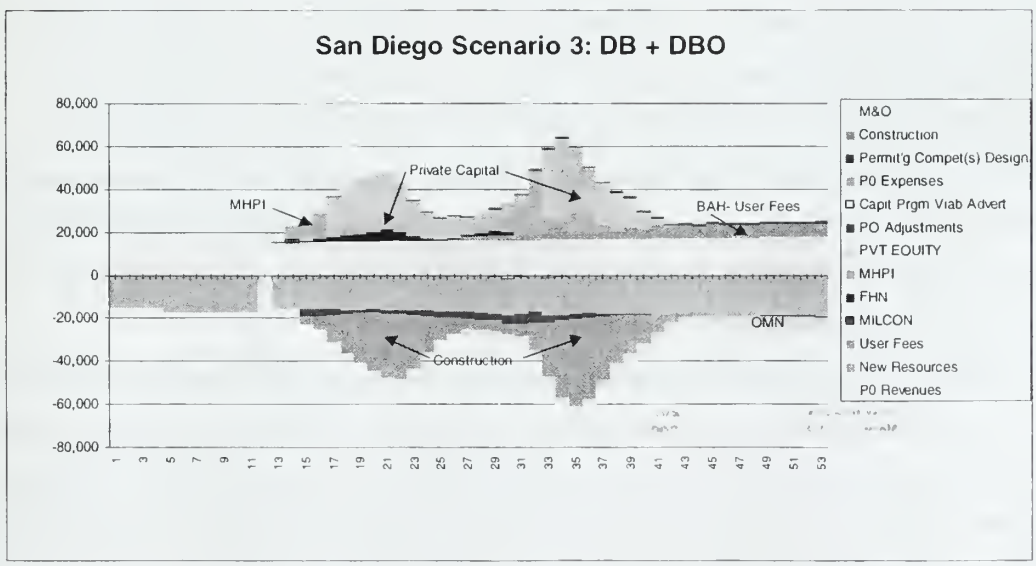


Figure 4-34 San Diego Integrated Scenario

In comparing the DBB baseline (as illustrated below in Figure 4-35 by the shaded area) with the potential outlays for an integrated delivery approach with significant indirect financing, the monetary and time savings become readily apparent. Full expenses are still displayed, however, only the Navy's projected revenues are shown as a single black line. The effect is seen in both a capital requirements reduction and also as a leveling affect in annual capital required.

Aggregate Comparison of Portfolio

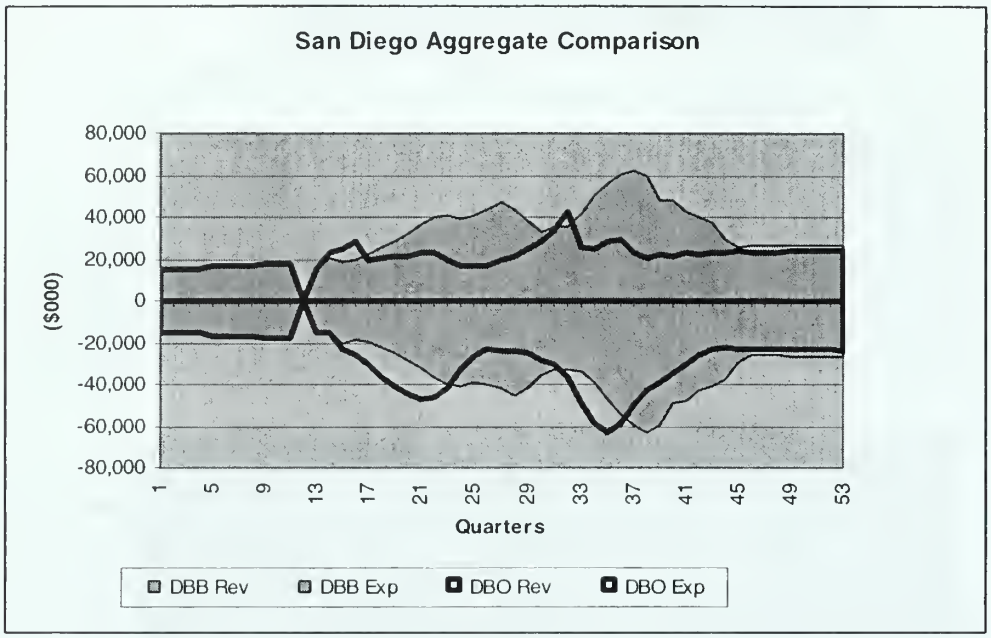


Figure 4-35: Aggregate Comparison of San Diego Portfolios

4.5.1.5 Cash Flow Analysis

Basis of Project Financing

The LLC solicitation presents two particular specifications that have a significant impact on the financial cash flow from the private sector's point of view. In keeping with sustaining private sector participation, the Navy must also understand the essential factors that drive private sector financial success. Cash flow analysis is essential to determine whether it is prudent for the Navy to invest and whether the profit incentives are balanced by a check on private sector windfall. These preliminary actions are critical to maintaining public confidence in what will be longest contract to date in Navy housing history or any other naval facility contract.

As the emphasis of this thesis is an analysis of contract delivery methods, detailed financial cash flow analysis is not the aim in this section. The analysis is a simple representation of a tool necessary in determining whether this delivery system is viable. The spreadsheet model was formed on the basis of rough a pro forma with numerous assumptions explained below. Despite its simplicity, trends can be seen that should invite further, detailed pursuit.

The two particular specifications in question of interest are:

- ❖ The Navy's $20.9 million contribution to support the private sector's development costs;
- ❖ The unusually long lease term of 50 years specified in the Request for Proposals.

As analyzed, the delivery method for this project requires private sector finance to leverage restricted government resources. The first hypothesis assumes a BOT (or DBFO) model, proposing 100% private sector development funding. Actually, a DBO model is utilized as the revenue stream is still generated by government funding through Basic Allowance for Housing (BAH) allotments.

Second, typical BOT or DBO schemes have concession periods of between 15 to 30 years. Too short of a period may not allow sufficient time for revenues to escalate and service a higher debt service payment associated with a short-term loan. Conversely, too long of a period ties both contracting parties into a relatively inflexible agreement. Although the LLC structure is supposedly flexible, it would be difficult to assume that a significantly more efficient means of project/portfolio management will not evolve within the life of the contract. Furthermore, permanent financing (such as issuing a bond) rarely lasts longer than 30 years as investors are leery of such extended term lengths. Therefore, the second hypothesis questions the feasibility of shortening the existing lease term of 50 years. (Medved et al 2000)

Cash Flow Modeling Procedure

The main assumptions for the pro forma are as follows:

- ❖ All cash flows are modeled in real terms based on 1999 dollar values.
- ❖ Real discount rates and interest rates are similarly adopted. For example, if the assumed interest rate for permanent debt is 8% in nominal terms, this is taken as (1.08/1.03 – 1)= 5% excluding an assumed 3% inflation.
- ❖ Operation & Maintenance expenses are estimated as $15.1 million annually, or a 10% level of the initial development costs. This value is based on a projection of the O & M costs at the New London Submarine Base, which is $12 million annually for a housing portfolio of 2500 houses (compared to 3284 houses in San Diego).
- ❖ Further, these O & M costs include both electric and gas utility expenses, but adjustment for these two items is not adopted for the rental revenue. The revenue chargeable by the private sector is assumed to be the same as the BAH for the purpose of modeling. In actuality, the rent stream is less as a nominal utility allotment is included in the Navy tenants' BAH. In other words, the utility costs are represented in both the revenue stream and O&M stream when in fact, they would not be included in either under the LLC agreement.
- ❖ Other assumptions include:

  A construction duration of 2 years;
  A construction financing interest rate of 10% nominal, or 7% real.
  A private sector discount rate of 10% nominal, or 7% real.
  An equity contribution level of 15% of development costs by the private sector for the base case without DON's $20.9 million contribution.

As discussed in Chapter 2, all cash flows are modeled in current dollars (i.e. real rather than nominal) and therefore all corresponding discount and interest rates are expressed in real terms without adjusting for an assumed inflation rate of 3%. According to the solicitation, the rental charges imposed by the private sector would be limited to the Basic Allowance for Housing (BAH) less an amount to cover

a predetermined unit electric and gas utilities charge. In modifying the CHOICES© modeling program to show this rent stream, the determination of "user fees" was based on the rental revenue determined from the pro forma below in Appendix B. Here the housing sizes and enlisted rating structures allowed an aggregate rental stream to be calculated.

The user fee estimation also takes into consideration the immediate and long-term renovations required by the contract. Initially all units are to be renovated over the first five years and then five percent of the portfolio will be renovated in years 11-50 as discussed previously under Scope. Real estate taxes were assumed at 1.5% after consult with Southwest Division's real estate lead on the LLC. (Megliola 2000).

The "user fees" generated from the previous pro forma were then used to generate cash flows in CHOICES© for a base case and three alternate scenarios. See Chapter 2 for an example layout of the CHOICES© "Chooser" which projects cash flows. Net Present Value (NPV) calculations for the four scenarios are demonstrated in Appendix B.

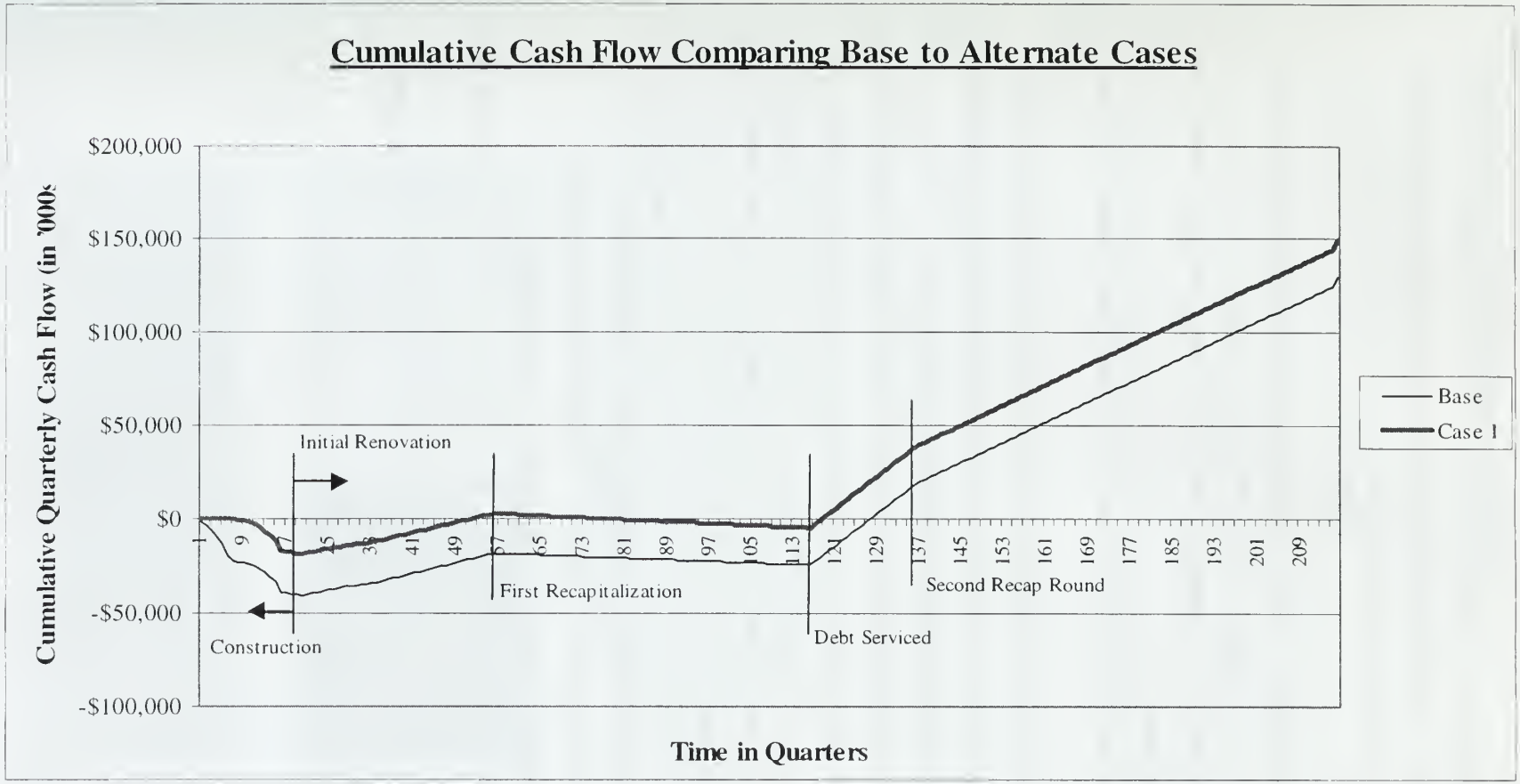


Figure 4-36: San Diego Cash Flow Analysis (Medved et al 2000)

Results and Implications

After the income stream analysis was done, the private sector's cash flow (equity contribution, interest payments, and net income) is separated to perform an NPV analysis. The preliminary findings based on this simplified analysis are interesting. Figure 4-36 shows the comparison of the base case versus the cases with Navy subsidy.

Base Case: This assumes that the Navy **need not** contribute the $20.9 million to the private sector in this PPV. The negative NPV (from the private sector's perspective) obtained implies that this hypothesis may not be feasible and the Navy is correctly enhancing the financial feasibility of the project to encourage private sector participation.

Case 1: This includes Navy aid of $20.9 million and a 50-year lease term. Contrary to the base case, NPV now turns positive.

Cases 2 and 3: These entail the same aid of $20.9 million, but shorten the lease terms to 30-and 35-years respectively. Shortening the concession period to a 30-year lease term lowers the NPV into the negative region, while a 35-year lease term still shows a viable, positive NPV.

The $20.9 million in aid has a tremendous impact because the private sector can use this to fund the up-front costs and delay equity contribution on their part by almost two years. This lowers the General Partner's costs (both direct and financing) tremendously. The savings is further enhanced by the discounting effect since, in the base case, most costs are incurred immediately as compared to the delayed effect on the expenses in the second case.

Additionally, the effect of revenues obtained forty to fifty years from now will have minimal effect after discounting to the present time. This implication is apparent by comparing cases 1, 2 and 3. The sensitivity of the latter years' effect on NPV is shown to be of lesser significance than initial development costs. Shortening the term may make this more attractive for both parties.

In speaking with several Navy personnel, the general idea behind the longer term is to protect the Navy's assets toward the end of the agreement. The thought is to require steady recapitalization over a longer period instead of returning the property to the Navy at the end of its useful life in a questionable state. (Forrest, Megliola, and Miller, M. 2000)

5 Discussion and Recommendations

5.1 Portfolio Management

5.1.1 Portfolio Analysis with CHOICES©

The Case Studies of Chapter 4 explored recent naval base housing community development activity and provided an excellent distribution of projects to illustrate the benefits of a portfolio planning tool, CHOICES©. The controls in this program enabled fluid manipulation of over 62 projects and their subsequent delivery packet variations. Several iterations of portfolio configurations at the base and agency (aggregate) level revealed the efficacy of such a tool in a dynamic infrastructure programming environment.

Three summaries of aggregate cash flows were developed according to delivery method and displayed numerically below in Figure 5-1. This summary provides a general comparison contrasting total life cycle outlays for Design Bid Build (DBB), Design Build (DB) and Design Build Operate (DBO) methods. The models within CHOICES© produced an aggregate life-cycle savings of close to $1.3 billion with a shift from traditional DBB to DBO projects. This may not be a reasonable expectation for the near future, however, it demonstrates the potential for immense savings in a clear format that could be standardized among and within agencies. In providing a simplified presentation of life cycle outlays, portfolio tools can play an essential role in shaping development policy and in implementing a sustained level of infrastructure upgrade.

Aggregate Comparison			
	DBB	DB	DBO
Revenues			
P0 Revenues	$5,327,709	$5,327,709	$5,327,709
MHPI	$0	$39,500	$184,645
MILCON	$841,020	$597,300	$209,550
FHN	$366,341	$302,354	$66,588
PVT EQUITY	$0	$135,843	$539,742
New Resources	$2,254,528	$1,542,655	$471,445
User Fees (BAH)	$0	$373,686	$1,253,309
Subtotal revenues	$1,204,728	$1,440,710	$2,245,859
Portion paid by Navy	$3,461,889	$2,855,495	$2,185,536
Expenses			
P0 Expenses	$5,802,171	$5,802,171	$5,802,171
PO Adjustments	-$474,462	-$474,462	-$474,462
Capit Prgm Viab Advert	$14,132	$13,089	$14,012
Permit'g Compet(s) Design	$74,560	$70,438	$75,360
Construction	$1,118,266	$1,006,583	$946,448
M&O	$2,252,297	$1,890,961	$1,673,378
Total Costs with Debt Service	$3,459,256	$2,981,070	$2,709,197

Figure 5-1: Agency Level Aggregate Cash Flow Comparison

A similar comparison between DBB and DBO Methods was generated graphically to illustrate the cash flows required to support delivery with each system in Figure 5-2. Several obvious advantages are made clear in this presentation. First, the level of expenditure is both reduced and stabilized. The integrated delivery and finance approach has leveled the revenue required to approximately $50 million / quarter. This portfolio represents over 15,000 houses or about thirty percent the continental United States military housing stock.[44] If the same cost reduction could be applied to the entire housing stock, savings of nearly 35 percent of the current $1 billion annual budget could be realized.[45] The other significant benefit is the acceleration in delivery as illustrated by the shift "left" in expenditures. Since expenditures are accounted for as work is actually put in place, this closely models improvement in delivery speed. The reality of execution will fall somewhere between the two extremes illustrated below as not all installations are good candidates for alternative methods nor is the Congress or the Navy ready to shift its entire stock at once.

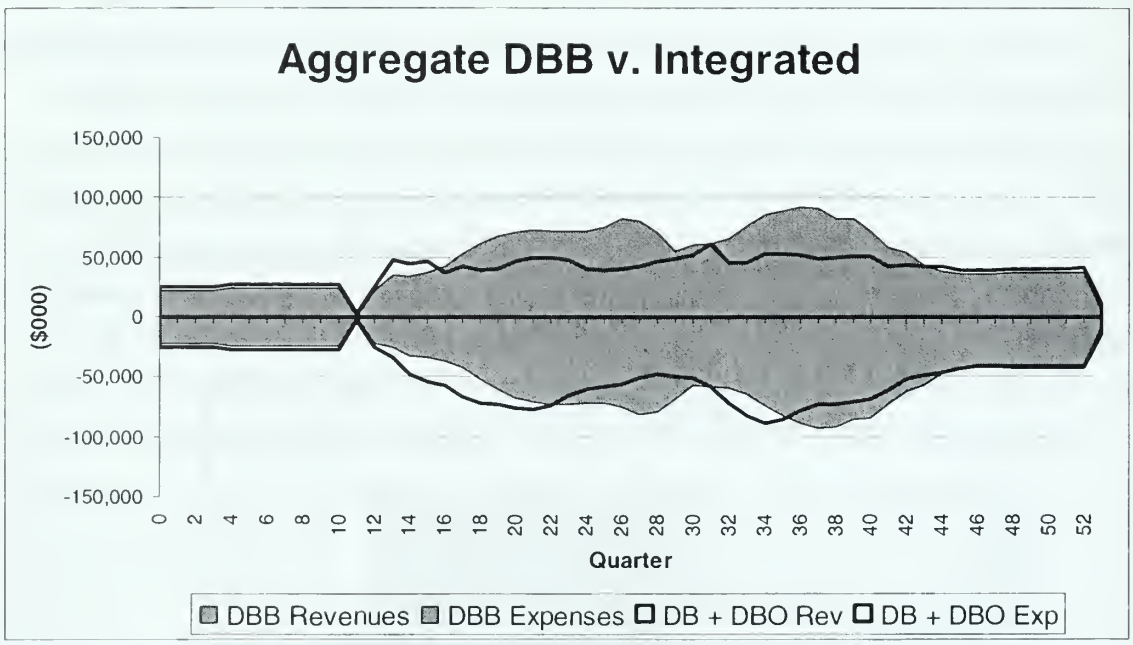


Figure 5-2: Aggregate Portfolio Cash Flow

Although not representative of the entire Navy housing stock, this set of case studies illustrates the power of a portfolio decision making approach upon program management. As the Navy has

[44] Puerto Rico's stock is not actually considered "continental" but was left in this calculation and in the aggregate chart as a substitution for numerous bases that have a similar stock and delivery method strategies (or lack thereof).
[45] However, this is an unrealistic view as currently these PPV projects are also those most feasible.

committed to a moderate pace of integrated PPV efforts[46], we cannot expect to see major increases in pace and savings until 1) legislation is extended in 2001 allowing further integrated delivery method usage, and 2) the ongoing PPV efforts prove to be successful. Leveraging future increases in pace would be more justifiable if requirements were stable and predictable as illustrated above in Figure 5-2.

Portfolio Tool Recommendation: It is recommended that the Armed Services develop a similar portfolio-driven planning system based on discounted cash flows for use at all levels. This approach will give both engineers and legislators the tools they need to focus on infrastructure life cycle and veer from annual project appropriations cycles that detract from sustainable planning methods. It will also standardize systems among and within sister Services.

5.1.2 Drivers for Specific Installations and Projects

In order to support implementation of a portfolio-oriented infrastructure strategy, planners need a menu of delivery methods and the practical tools to determine which methods are viable for specific projects. The approach described in Chapter 2 illustrated a method used to eliminate poorly-suited delivery methods. This approach can complement delivery package construction within CHOICES© or a similar system.

The Navy has treated the majority of construction contracts as commodity enterprises. As the integration of design and operations services with construction becomes more prevalent, contracts will be structured more as performance-based systems. Bases and Regions must start integrating risk analyses, as demonstrated in Chapter 4, to weigh risks and allocate them appropriately. Additionally, as procurements shift towards integration, more NAVFAC personnel must be versed in several source-selection methods in addition to the prevalent low-bid method. This requires a major paradigm shift originating with congressional authorization of choice in finance and delivery methods. Until then, the building blocks for integrated delivery need to be disseminated to installation staffs from Engineering Field Divisions where authority, experience and knowledge for these efforts are currently held.

Project Delivery Selection Process Recommendation: NAVFAC should develop a delivery system matrix that includes viable combinations of scope (as defined in Chapter 2 as level of integration), organization, contract and award methods. This should be available for use at base and region levels in lieu of predetermined means. Currently, even as most methods of scope and organization are limited by law and regulation, contract and award method skills such as "best value" source selection can continue to be developed. Establishing a toolbox of viable contracting methods and training people to use them is the first step in enabling effective portfolio management.

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[46] The level of PPV "seed" money is projected at $15M in FY02 to $27M in FY07 according to the FY07 POM-02 Navy Family Housing Baseline Assessment Memorandum, March 2000. This represents between only 6% and 9%

5.2 Strategies

5.2.1 Fundamental Elements / Engineering Systems Integration

As discussed in Chapter 2, there exist ten Fundamental Elements that will enable robust infrastructure development strategy. The Armed Services' recent pursuit of integrated housing delivery is one step in fulfilling such a strategy. Utilities and other systems will soon follow. Several Fundamental Elements are currently present within the Navy's pursuit of Housing development and refurbishment.

5.2.1.1 Exercising the Fundamental Elements

Client Defined Scope: The Navy "knows what it wants" in terms of quantity and quality of housing and has specified this in terms of performance. Generally, technical and financial objectives for integrated delivery are well defined in Navy PPV solicitations. However, the undefined quantity of housing requested in Everett's second solicitation may require further refinement. The solicitation establishes a minimum number of units and a minimum term length, but allows the contractor to define higher quality, quantity and term-length configurations with the general premise that better quality for a longer period is desired.

Head to Head Competition: Everett's latest solicitation may make it difficult to compare offers in "head to head" competition if they differ in configuration and term length. However, thus far throughout the PPV program, there has been heavy and "head to head" competition with all the teams vying for cleanly defined projects.

Fair Treatment: The Navy's respect for Fair Treatment of Actual Competitors has been fervently upheld. Contracting Officer's teams are so protective of the competitive proposal process that they refuse to release the even names of the "qualified" teams prior to contract award. One scare came from the Army's first PPV effort at Fort Carson that was delayed substantially in a bid protest.

"Safety": The Navy reviews all designs provided by independent Architect/Engineer (A/E) firms, a process geared toward segmented delivery where there is a fiduciary relationship with the A/E. However, the new LLC organizational structure established by the San Diego PPV requires a Resident A/E to check all design-build efforts.

Competition Open to Technical Change: The Navy is slowly releasing its stranglehold on detailed specifications and has presented a modified set of "performance" specifications in new PPV efforts. These offer ample opportunity for innovation and efficiency that can enhance construction and operations.

Sound Financial Analysis Over the Project Life Cycle: Recent PPV solicitation packages include standard templates for contractors' financial proposals offering a common framework upon which to

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of the overall projected budget for new housing construction and improvements.

compare life cycle costs. The standard analysis takes into considerations all financial, development, and operational costs for the life of the project in addition to Navy profit sharing, equity, and subsidy requirements.

5.2.1.2 Further Development of the Fundamental Elements:

"Transparency": Although the source selection process in all the PPV solicitations was standardized, the new process will require incremental upgrades and broad dissemination to ensure that firms, NAVFAC personnel, and legislators all understand the process. All the services should use a similar method, which is not currently the case. Also, many firms are still leery of the government's commitment to making this a sustainable delivery system. Legislative Adoption of a standard template like that in the ABA Model Procurement Code would allay these concerns in private industry. The Armed Services need to signal strongly to the private sector that 1) current ventures are being conducted fairly and 2) they are committed to similar ventures in the future. In that light, the Navy has demonstrated its respect for the high cost of proposal preparation by "qualifying" only four teams to submit proposals per project.

Dual Track Strategy: Although the recent shift in housing and utilities "privatization" has driven a fraction of NAVFAC contracts into Quadrant I, housing and other programs remain on single track strategies, relying upon direct government funding. Once the Services have become proficient in delivering Quadrant I contracts, they should develop opportunities for firms to deliver infrastructure services independently Quadrant II. In housing, this can only occur if BAH actually rivals current housing rates. Perhaps this will be possible if the Defense Secretary's BAH increase initiative is successful.

Scenario Building: Scenario building is not implemented at most bases. At the region and headquarters levels, annual programs are generated from regional inputs, but projects compete on their individual merits. Portfolio interaction, delivery methods and finance methods are not primary factors in selection criteria.

Pace: Use of standard portfolio software that presents life cycle costs at base levels could be rolled up to regional and headquarters (agency) levels to allow for long-term optimization and resource leveling. This process would lead to projections that could leverage an increased level of investment from Congress if projections similar to the aggregate cash flow in Figure 5-2 were feasible.

5.2.1.3 Quadrant Notes

The following notes describe portfolios of the Chapter 4 Case Studies:

DBB: New London and Roosevelt Roads

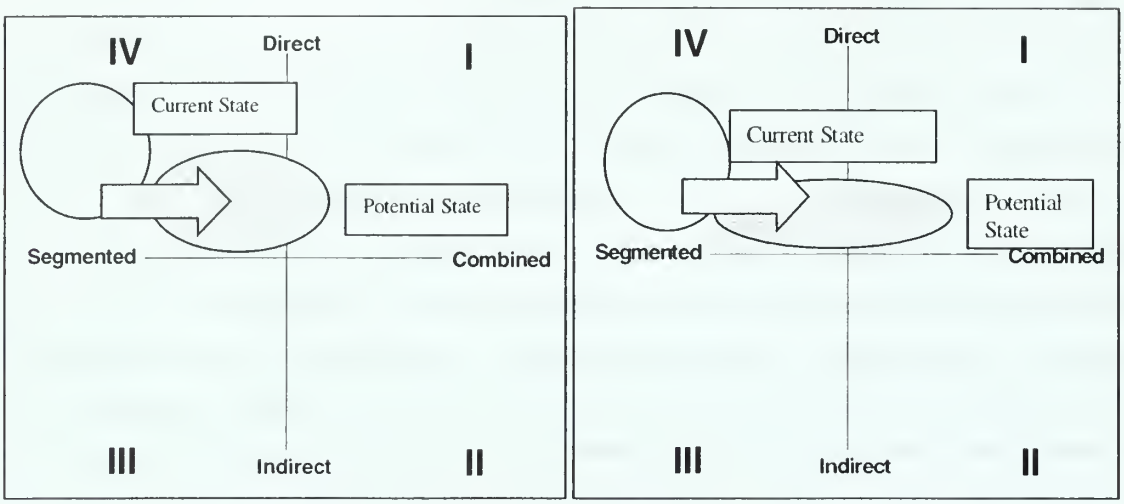

Figure 5-3: New London and Roosevelt Roads Quadrant Orientations

The portfolio at New London is currently planned under typical DBB execution methods, methods that have been time-tested to be fair and transparent. This typical approach leaves little opportunity for technological change. There is little incentive to improve housing constructability or operational efficiency. Financial analysis is limited to initial capital cost and packages are treated as commodities in sealed bidding award processes. Again, there is no consideration or capability to measure the effect of capital expenditures on future O & M. The "Potential State" set indicates the integrated scenario described in Chapter 4 where four of the eighteen housing projects could be delivered under DBO contracts and the remainder under DB contracts. Certainly, the pace of construction could be expedited, quality improved, innovation incorporated and life-cycle costs reduced if acquisition decisions for the entire 2,500 house portfolio were based on scenarios.

Naval Station Roosevelt Roads (NSRR) utilizes segmented, directly funded project delivery almost exclusively. This is rather conservative, even when compared to the Commonwealth of Puerto Rico's infrastructure strategy. Strong local growth and typical public project constraints have forced the local public authorities to pursue alternative methods in order to delivery essential infrastructure. While NSRR has enjoyed relatively modern and reliable infrastructure compared to neighboring townships, it too, is now facing funding constraints that severely limits even maintenance of the status quo. Eventually, NSRR will be forced to consider alternative methods to upgrade its decaying facilities.

DB: Ventura

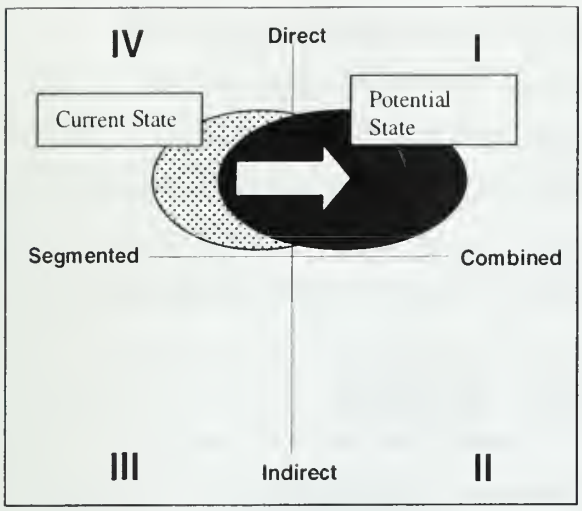

Figure 5-4: Ventura Quadrant Orientation

Currently the Ventura Naval Complex has a fairly diversified housing portfolio. They have employed DBB, DB and DBO methods to build and rebuild communities in three separarate areas. This is the only base in this study that has employed design build and leasing instruments simultaneously. Portfolio management will become more relevant with the recent consolidation of assets where the larger inventory and single point of management should provide more delivery integration opportunities.

DBO: LLP Applications at Everett and South Texas

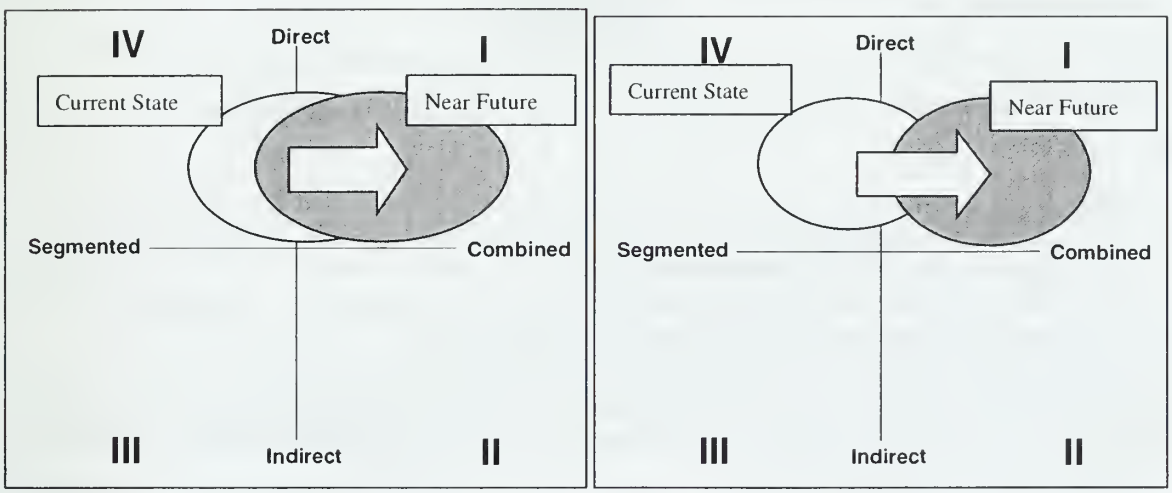

Figure 5-5: Everett and South Texas Quadrant Orientations

Everett has placed most housing properties in Quadrant I. The base housing office still manages 180 government-owned units, but will shortly reduce this inventory to 75. The number of units delivered by leasing should also drop significantly in Fiscal Year 2003 when the second LLP venture is completed.

Unlike most portfolios where there is potential to partially or completely shift into Quadrant I, South Texas is actually shifting the entire housing community there with current PPV efforts. Furthering integration efforts, the separarate Public Works and Housing Offices that currently support four housing comunities may soon be absorbed into one regional Public Works Center.

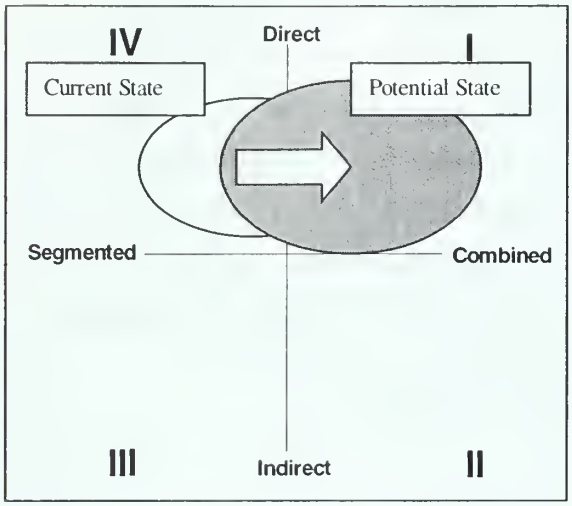

Figure 5-6: San Diego Quadrant Orientation

San Diego's leading role as the largest Navy PPV to date and robust seven-year capital program make the "Potential State" in Figure 5-6 plausible. SDNC's commitment to consistent upgrades of specific communities like "Murphy Canyon" with over 1800 units, and "Gateway" with nearly 600 units could lend well to DBO scenarios. Additionally, projected new construction in the "out years" shows potential for 1500 new houses. This large development may lend to shorter LLP-type agreements if developable Navy land becomes scarce.

5.2.1.4 Recommendations

Building upon a foundation of project and portfolio planning through use of strategic tools will assist in executing strategy founded in the Fundamental Elements. Some of the significant areas to concentrate on include:

- Signal clearly that integrated procurement will continue to provide private sector opportunity.
- Use third party benchmarking act as a catalyst for fierce competitions enabling cost savings and performance upgrades through innovation.
- Move from the current state toward a dual track strategy as illustrated below in Figure 5-7.
- Shift other-than-housing and utility ventures out of Quadrant IV.
- Employ a system similar to CHOICES© that is usable at all levels.
- Use these tools to communicate needs and strategy more clearly to both Congress and the private sectors in order to leverage a higher pace of execution through more efficient delivery and increased levels of investment.

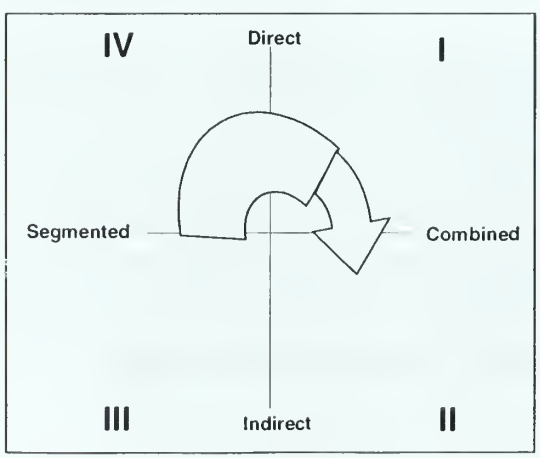

Figure 5-7: Future Trends in Government Infrastructure Procurement

5.2.2 Five Forces and Industry Structure

The Navy should take into consideration the attractiveness of the infrastructure segments they create as a significant buyer of services. Next, they should determine what type of private firm generic strategies will be contribute most to the advancement of their aging infrastructure systems. NAVFAC can apply some of the same concepts internally to improve effectiveness by keeping personnel in tune with private sector issues.

5.2.2.1 Tapered Integration in the Housing Value System

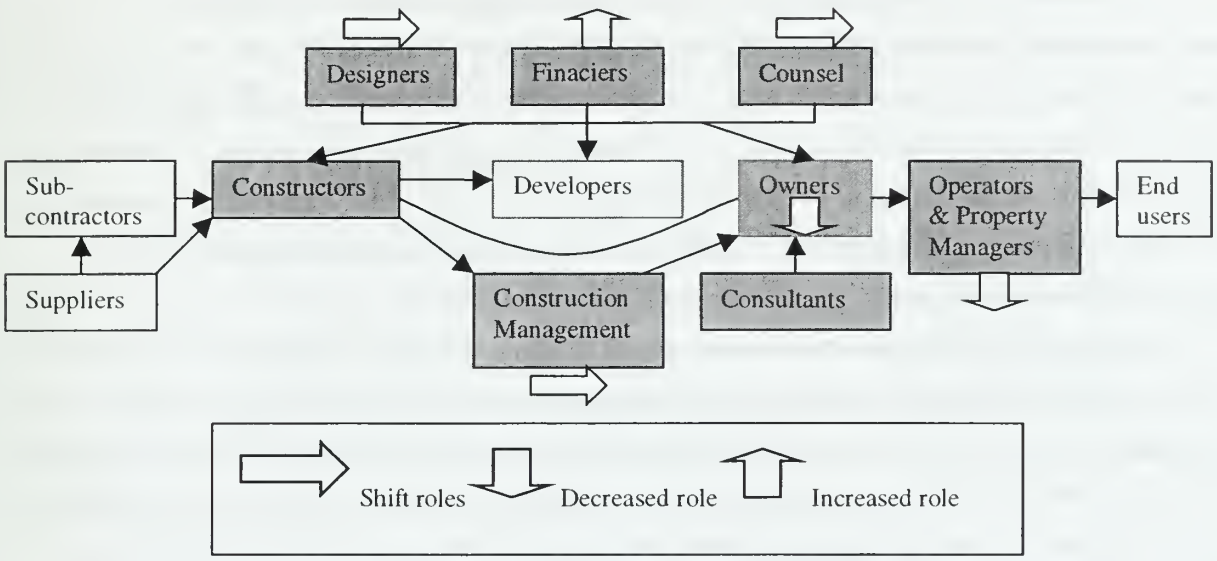

Figure 5-8: Potential Shifts in NAVFAC Housing Value System

Structural Changes

In analyzing NAVFAC's current housing value system, it appears that several alterations to their tapered interfaces would create a structure more conducive to portfolio management through use of several delivery methods. No single value chain should need be divested of entirely, however, current levels of involvement should be altered in Design, Finance, Counsel, Construction Management, Ownership and Property Management. Recommended shifts are illustrated above in Figure 5-8.

Design. Housing design is generally out-sourced, however NAVFAC engineers and architects who specialize in specific systems can focus their efforts into developing performance specifications that provide more room for innovation. This is particularly important in the housing industry where most technical applications are directly transferable between private and public sectors.

Finance. A higher need for financial analysis, real estate knowledge and accounting methods is relevant to implementing integrated delivery with indirect financing. Since the Navy's fund source has been almost entirely direct, these areas require the greatest development. This could be done entirely through consulting, but if it is to become a mainstream part of procurement strategy, in-house expertise

needs to be expanded. Additionally, methods such as Activity Based Accounting should be implemented to tie operations, design and construction costs together in a system that can contrast past and present performance of specific systems.

Counsel. NAVFAC's attorneys should play a large part in restructuring contractual structures toward an integrated delivery paradigm. Implications of integrated procurements are more far reaching than typical DBB contracts and therefore the preparation work in contractual structure is essential to long-term performance and flexibility.

Construction Management. The Navy's construction managers (Officers in Charge of Construction) need to become more skilled in proposal negotiation processes as most of their work is currently bid. They will also need to restructure administration efforts because integrated procurements will require varying levels of interface where current contracts are engaged in a more uniform manner. These procurements will also require a closer working relationship with Public Works entities as design, and operations issues come into play more. NAVFAC has already taken a step in this direction by placing all construction offices under the purview of public works officers.

Ownership. Navy real property ownership may diminish with Base Realignment and Closure, but it will become more complex as a variety of ownership structures will offer more interplay with the private sector. Several variations are currently being used in PPV and Asset Management efforts. In San Diego's LLC venture, family housing, infrastructure and underlying land will be transferred via a long-term lease (50-year) to a managing partner. Upon lease expiration, the property will revert to the Navy. A more permanent, but similar agreement, would entail selling the property and leasing it back in a "buy, lease-back." In the case of LLPs, the managing partners provide land and housing units. In both PPV cases, the Navy maintains the right to occupy any "privatized" units through a "first right of refusal" clause that also allows leasing to civilians on a short-term basis should navy demand wane. Another aspect of real property management comes in the form of "enhanced-use" leases or "land exchanges." Here, underutilized land and buildings can be marketed for use to the private sector in exchange for income or services that would improve infrastructure. Housing and associated real property do not always tie to inherent military functions and divestment or outsourcing of such assets should be a continual consideration.

Property Management. The same is true for housing property management, however, this function will diminish, it will simply transform from direct management toward DBO interface and referral service

In essence there is no great need to shed jobs, only to transform them to meet new requirements better. The corporate knowledge for integrated procurement held at Engineering Field Divisions and Headquarters should be translated to Installations as a part of this transformation.

A Fresh Alternative

A more radical option altogether would be to out-source the entire housing value system as the Canadians and British. The Canadian Department of National Defence recently established the Canadian Forces Housing Agency, a quasi-public agency, that centrally manages nearly 20,000 crown-owned and leased units. They are chartered to ensure that military families have access to suitable, affordable housing and to manage existing portfolio assets. Crown-owned and leased assets are being managed on a "break even" basis using only rent streams as a revenue source. Rents are set by the Agency to market rates and all maintenance and improvements are out-sourced. Leadership is provided by a Chief Executive Officer reporting directly to the Deputy Minister of Defence and the Chief of the Defence Staff. (www.dnd.ca/eng)

5.2.2.2 Sources of Competitive Advantage

Segmentation

The following segmentation matrix represents how the bases in Chapter 4's Case Studies have employed procurement methods. Several matrices representing delivery method, project size and real estate activity were reduced to a single matrix. Although this does not illustrate all the housing markets that EPC firms pursue, it does provide a tool with which NAVFAC can analyze its positioning of solicitations in accordance with regional needs. Further segmentation matrices for each region should be developed to analyze forces of industry fragmentation on distinct market segments.

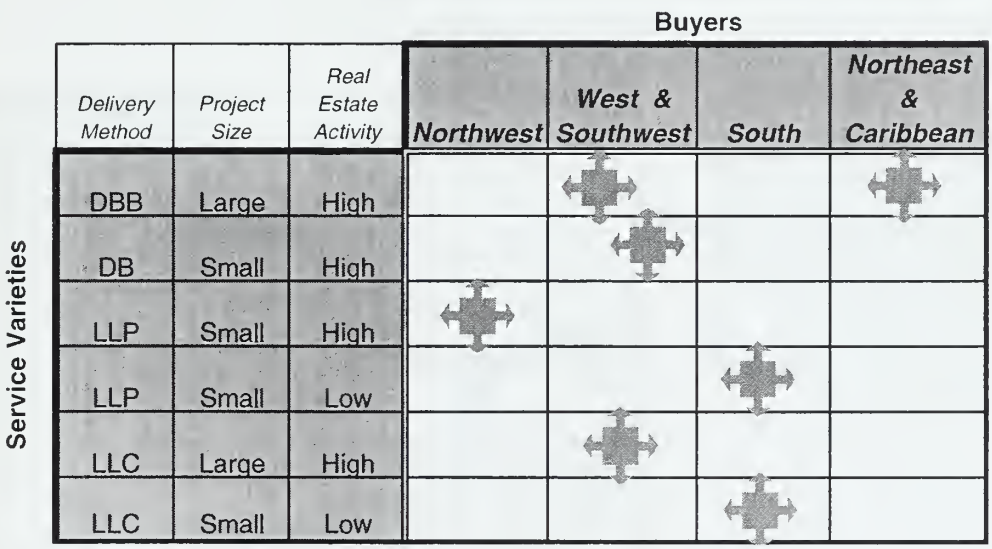

Figure 5-9: Navy Housing Delivery Segmentation Matrix

Five Forces Analysis

The two lightly shaded segments from the matrix above in Figure 5-9 are depicted below. San Diego segments were chosen for comparison because this region currently executes housing contracts in both Quadrant I and IV. Most other bases are delivering housing projects almost entirely by one

approach. The comparison between DBB and DBO methods below in Figure 5-10 and Figure 5-11 shows that DBO methods offer a better balance of forces and provide more opportunity for firms to create sustainable, competitive advantage.

Generic Strategy Advantage

Firms that choose to compete in the DBO segments will have to rely on different generic strategies than those in the DBB segment. Basically, firms seeking cost advantage will remain in the DBB segment and differentiated firms should thrive in the DBO segment. NAVFAC should strive to provide opportunity for a variety of firms' generic strategies to be successful in providing infrastructure. The resulting diversity of private sector approaches will lead to better solutions and performance for the long-term.

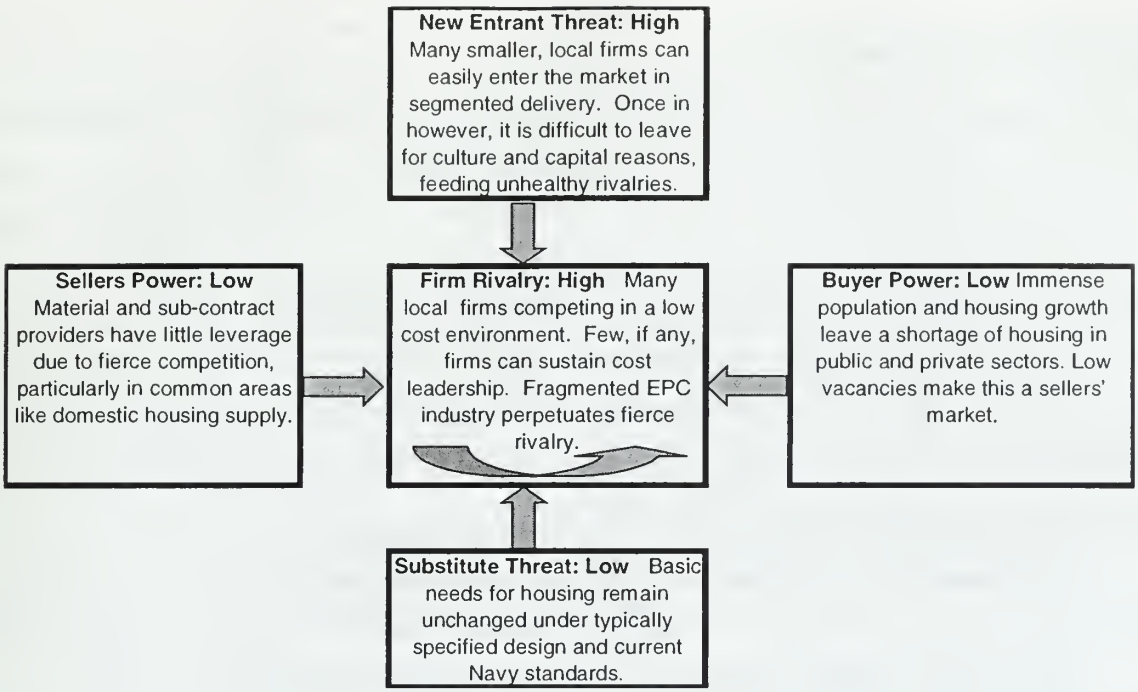
New Entrant Threat: High
Many smaller, local firms can easily enter the market in segmented delivery. Once in however, it is difficult to leave for culture and capital reasons, feeding unhealthy rivalries.
Sellers Power: Low
Material and sub-contract providers have little leverage due to fierce competition, particularly in common areas like domestic housing supply.
Firm Rivalry: High Many local firms competing in a low cost environment. Few, if any, firms can sustain cost leadership. Fragmented EPC industry perpetuates fierce rivalry.
Buyer Power: Low Immense population and housing growth leave a shortage of housing in public and private sectors. Low vacancies make this a sellers' market.
Substitute Threat: Low Basic needs for housing remain unchanged under typically specified design and current Navy standards.

Figure 5-10: San Diego DBB Segment Five Forces Analysis

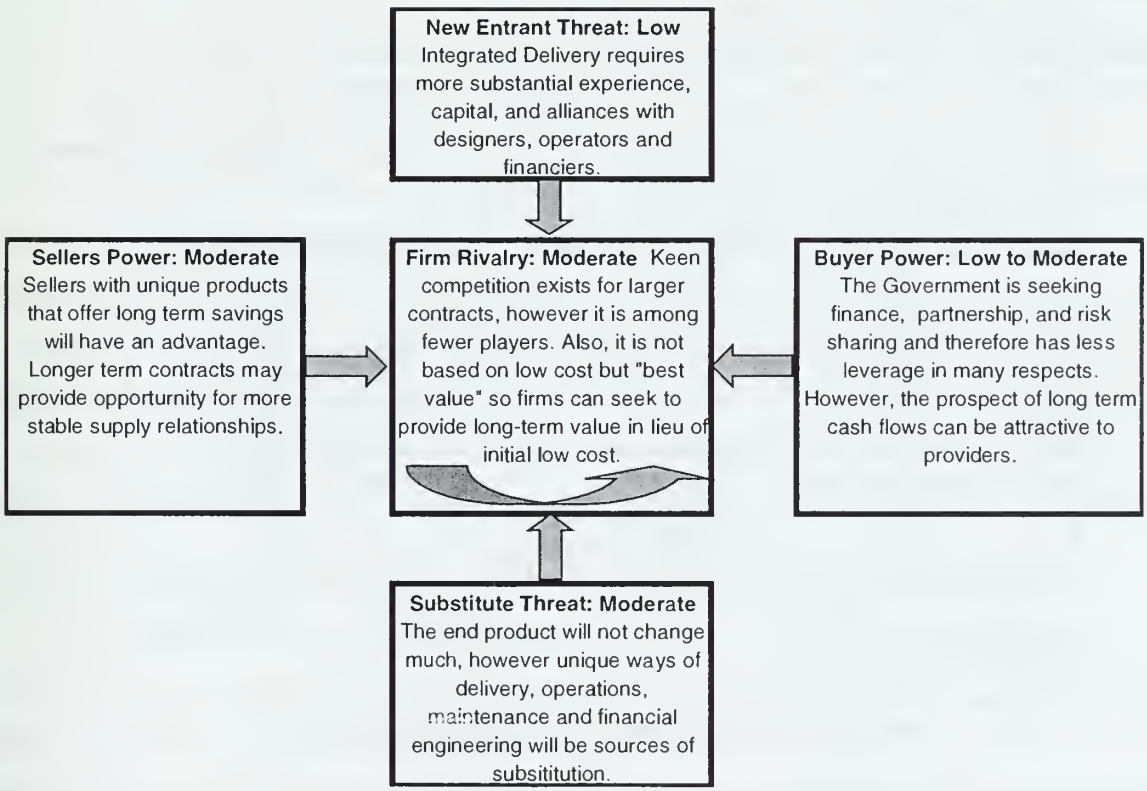
New Entrant Threat: Low
Integrated Delivery requires more substantial experience, capital, and alliances with designers, operators and financiers.
Sellers Power: Moderate
Sellers with unique products that offer long term savings will have an advantage. Longer term contracts may provide opportunity for more stable supply relationships.
Firm Rivalry: Moderate Keen competition exists for larger contracts, however it is among fewer players. Also, it is not based on low cost but "best value" so firms can seek to provide long-term value in lieu of initial low cost.
Buyer Power: Low to Moderate
The Government is seeking finance, partnership, and risk sharing and therefore has less leverage in many respects. However, the prospect of long term cash flows can be attractive to providers.
Substitute Threat: Moderate
The end product will not change much, however unique ways of delivery, operations, maintenance and financial engineering will be sources of subsititution.

Figure 5-11: San Diego DBO Housing Segment Five Forces Analysis

5.2.2.3 NAVFAC Firm Value Chain

The following Firm Values Chains (FVCs) and their linkages address changes that may better structure NAVFAC to delivery portfolios of housing projects more effectively. Many of the recommendations parallel the Value System changes proposed above. The diagram in Figure 5-12 represents Headquarters functions. Regional (Engineering Field Divisions/Activities), Installation corollaries, and a linkage diagram connecting all three, can be found in Appendix C. Linkages between the FVCs are very linear, tying directly among categories, as firm structure and function are similar at all three levels. However, capacity to implement recommended changes rests mainly in the Upper FVCs at Headquarters and Engineering Field Divisions. Recommendations focus on improving factor conditions, internal structure, and signaling demand for alternative delivery.

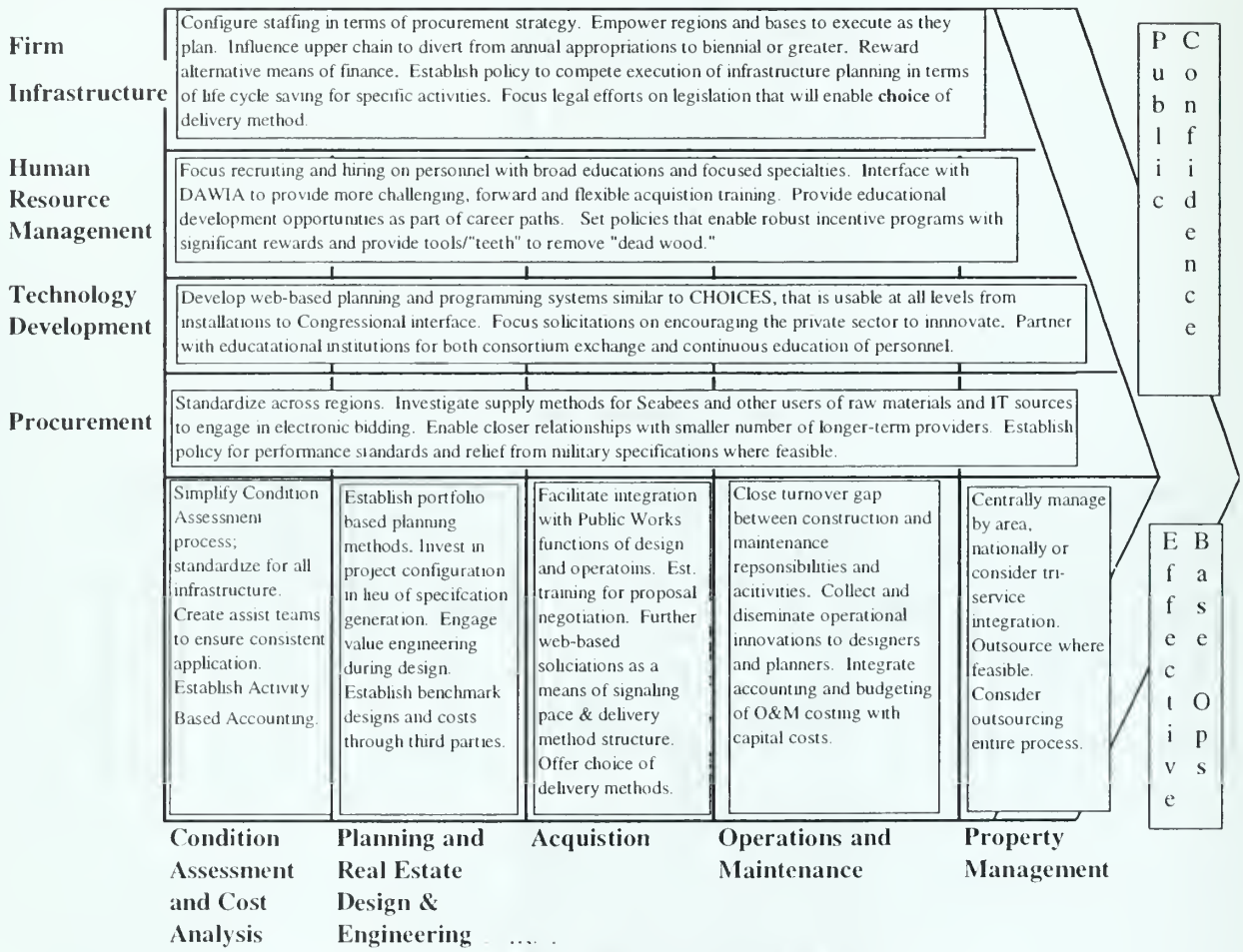
Firm Infrastructure
Configure staffing in terms of procurement strategy. Empower regions and bases to execute as they plan. Influence upper chain to divert from annual appropriations to biennial or greater. Reward alternative means of finance. Establish policy to compete execution of infrastructure planning in terms of life cycle saving for specific activities. Focus legal efforts on legislation that will enable choice of delivery method.
Human Resource Management
Focus recruiting and hiring on personnel with broad educations and focused specialties. Interface with DAWIA to provide more challenging, forward and flexible acquistion training. Provide educational development opportunities as part of career paths. Set policies that enable robust incentive programs with significant rewards and provide tools/"teeth" to remove "dead wood."
Technology Development
Develop web-based planning and programming systems similar to CHOICES, that is usable at all levels from installations to Congressional interface. Focus solicitations on encouraging the private sector to innovate. Partner with educatational institutions for both consortium exchange and continuous education of personnel.
Procurement
Standardize across regions. Investigate supply methods for Seabees and other users of raw materials and IT sources to engage in electronic bidding. Enable closer relationships with smaller number of longer-term providers. Establish policy for performance standards and relief from military specifications where feasible.
Simplify Condition Assessment process; standardize for all infrastructure. Create assist teams to ensure consistent application. Establish Activity Based Accounting.
Establish portfolio based planning methods. Invest in project configuration in lieu of specifcation generation. Engage value engineering during design. Establish benchmark designs and costs through third parties.
Facilitate integration with Public Works functions of design and operatoins. Est. training for proposal negotiation. Further web-based solicitations as a means of signaling pace & delivery method structure. Offer choice of delivery methods.
Close turnover gap between construction and maintenance repsonsibilities and acitivities. Collect and diseminate operational innovations to designers and planners. Integrate accounting and budgeting of O&M costing with capital costs.
Centrally manage by area, nationally or consider tri-service integration. Outsource where feasible. Consider outsourcing entire process.
Condition Assessment and Cost Analysis
Planning and Real Estate Design & Engineering
Acquistion
Operations and Maintenance
Property Management
Public Confidence
Effective Base Ops

Figure 5-12: NAVFAC Housing Firm Value Chain Refinements

Planning Through the Firm Value Chains

At the installation level and even at the headquarters level, systemic, heavily regulated methods make it difficult to strategically plan. One must authoritatively use authority in order to plan. "Planning

requires law, choice, priorities, and moralities." (Lowi 1979) NAVFAC Firm Value Chains (FVCs) are limited in their ability to actually choose and are tightly restricted by laws that predetermine finance and delivery methods. Even at the DOD level, projects are still subject to congressional control and approval. There is no tie between control of the funding and those doing the planning, therefore the planning function is seriously degraded.

The structures of NAVFAC's Firm Value Chains are not optimally configured for acquisition through alternative finance and delivery. A more efficient structure focused on integrating Condition Assessment, Performance-based Contractual Configuration, Life Cycle Analysis, and Portfolio Management is needed if NAVFAC is to meet 21st Century expectations of higher efficiencies and returns with less personnel. Investment in Factor Conditions fully supporting this sort of structure has yet to be established. NAVFAC is strongly supporting training and education, however, they are focusing on well-intended, but constrained, governmental objectives for procurement. In the current framework, Agency tools that enable change will come slowly and incrementally.

In order to effectively meet current infrastructure challenges, NAVFAC FVCs will need to change the way projects are developed and proposed. The influence and priority of Installation-level requirements is nearly impossible to be conveyed at the congressional level where actual project authorization takes place.[47] Perhaps there are ways to better support current needs in light of base or region-wide requirements, within the existing system,.

Programming Paradigm Shift

Proposing projects as elements of a portfolio system is one way to garner support through the NAVFAC FVCs and on to Congress. Tying the effects of timing, cost, finance and delivery methods to savings and improvements in a portfolios would illustrate the effects upon operating costs, overall cash flow required to support the community, and pace of execution. This would put execution in terms of life cycle. Potentially this could provide the necessary links between MILCON and O & M funding streams that are currently viewed separately and are handled without direct regard for one another. This type of portfolio management system should be established in a manner that requires all Installations, Regions, Services and Agencies could present their requirements within the same context.

Portfolio Execution Plans

Another proposal is the execution of entire base or regional programs in a manner similar to current public/private ventures. Bases or regions would propose portfolio execution plans that would go through a rigorous approval process like the PPV process illustrated in Chapter 3, but would not be required to go through that same process every year. As long the base or region stayed within approved guidelines they would be free to execute with autonomy in accordance with local needs and priorities.

Amendments and new programming requirements would be approved as an integral part of the portfolio package instead of individually. Annual execution reports would be submitted to approving authorities. These progress reports would also serve to promote healthy competition among bases or regions over effective plan execution and innovative cost savings methods. Cost savings would be rolled directly back into local programs.

5.2.3 Competitive Advantage at the National Level

The Navy will continue to choose the road to high and rising productivity through enabling vigorous competition in support of infrastructure development. There are always new ways to invest in people and specialized infrastructure that enable efficient operations. Navy leaders, must continue to embrace change as a constant and force training and education to support continual upgrade. The Navy should continue to set standards in Technical Quality, Safety, the Environment and Health, but it should shift away from dictating how products and services are to be delivered. It should do everything possible to enable firms to develop their own source of Competitive Advantage by encouraging innovation in contract execution. Internally, the entire NAVFAC organization must strive to redefine job descriptions and organizational structure as infrastructure and delivery needs change. Change must be embraced at all levels as a source of advancement through honing of Factor Conditions, Demand Conditions, and Firm Structure.

Factor Conditions: Direct investment and significant upgrades in housing are strong forces in establishing the attractiveness of Navy careers in terms of Quality of Life. The Navy and other Services are effective at providing basic Factor Conditions, however, NAVFAC should embrace industry and educational institutions as a source of higher-level factor conditions. One source of advanced factor investment would be to engage consortia at several universities around the U.S. similar to the Construction Industry Institute (University of Texas at Austin), Center for Integrated Facility Engineering (Stanford University), and the American Infrastructure Consortium (Massachusetts Institute of Technology). Investing in advanced factor conditions should be paralleled with raising education and training standards/requirements for both military and civilian employees.

Demand Conditions: NAVFAC can also hone the housing infrastructure "diamond" by influencing Demand Conditions in several ways. First, they can establish new business segments similar to Limited Liability Partnerships and Corporations. Next, they can apply strong pressure to meet increasing standards and to innovate. The housing industry and other infrastructure industries are excellent foundations for creating synergy between civilian and military communities. If demand conditions are applied correctly through a variety of delivery and finance methods, private industry will

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[47] Why these decisions are made at the congressional level would be another thesis topic.

be willing to innovate on behalf of the military because their efforts will translate to Competitive Advantage in the private sector.

Structure/Rivalry: Restructuring internal organization and procurements will allow NAVFAC and industry to align with sources of Competitive Advantage. By providing an innovative environment, NAVFAC will promote retention of the most qualified personnel and encourage stagnant employees to upgrade their credentials and experience. The strongest source of infrastructure upgrade is to continue supporting fierce domestic rivalry through well-structured solicitations.

5.3 Opportunities in Other than Housing

The Defense Reform Initiative Directive parallels the Military Housing Privatization Initiative and is driving outsource exploration for over 2,300 DOD utility systems. This initiative shows enormous potential for cost savings as the DOD accounts for over 70% of all federal government energy consumption. Further, utilities make up the majority of government O & M funding (at $2.4 billion / year) which, in turn, is the largest portion of the infrastructure budget. (Yim 1999) The next area that deserves attention of alternative finance and delivery methods is the Military Construction Program (MILCON). Here, the diverse spectrum of projects covered by the MILCON program may not offer economies of scale present in more uniform housing and utility programs, but opportunity for upgrade in an annual DOD program of $3 billion is full of potential benefits for the taxpayer, military, and private sectors.

5.4 Summary

Military infrastructure plays an essential role in supporting the emerging needs of our nation's dynamic growth and global interaction. The condition of the Armed Forces' housing stock is a key element in retaining highly qualified personnel. Housing development initiatives will be a leading indicator for broader infrastructure development and renewal in the 21st century. Facilitating three themes will enhance the leadership effectiveness of DOD infrastructure stewards.

- First and foremost, military infrastructure planners must be empowered with the opportunity to make strategically significant decisions early in project life cycles. This requires a major paradigm shift originating with congressional authorization of choice in finance and delivery methods. In exercising choice of configuration, planners can have the greatest influence on innovation and resulting improvements in project cost, quality, and delivery speed. Accordingly, private industry will benefit from the opportunity to employ more diverse strategies.

- Next, project development should be viewed at a portfolio level from the configuring engineer to the authorizing legislator. This forces an aggregate life cycle view of infrastructure that can surmount short-term political barriers and encourage higher levels of investment.

- Finally, a return to balanced integration of public and private assets and expertise is vital to sustaining American military infrastructure upgrade in support of high and rising military readiness expectations.

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APPENDIX A

New London Pro Forma

Variables	
Subsidy =	35.0%
Discount Rate =	10.0%
Debt Service Rate =	8.0%
Term of Debt =	30

	Dolphin Gardens	$/unit	Polaris Park	$/unit	Fairfield	$/unit	Mitchel Complex	$/unit
Project Cost	32,092,874	114,617	16,908,000	169,080	2,585,000	92,321	30,395,000	110,127
Subsidy	11,232,506		5,917,800		904,750		10,638,250	
Total Project Cost	20,860,368		10,990,200		1,680,250		19,756,750	
Monthly BAH Payment	800		950		800		800	
Max # Payments	280		100		28		276	
Annual BAH Payment	2,688,000		1,140,000		268,800		2,649,600	
Vacancy @ 5%	2,553,600		1,083,000		255,360		2,517,120	
O&M	161,280		68,400		16,128		158,976	
Debt Service	1,852,973		976,231		149,252		1,754,941	
NOI	539,347		38,369		89,980		603,203	
Present Value of Max Payments	5,084,378		361,699		848,231		5,686,339	
Annual BAH as % of Project Cost	8.38%	2.09%	6.74%	1.69%	10.40%	2.60%	8.72%	2.18%

Sensitivity of Net Operating Income with varying BAH. Highlights show average rent stream required to yield positve NOI.	BAH	NOI	BAH	NOI	BAH	NOI	BAH	NOI
		539,347		38,369		89,980		603,203
	0	-1,852,973	0	-976,231	0	-149,252	0	-1,754,941
	100	-1,553,933	100	-869,431	100	-119,348	100	-1,460,173
	200	-1,254,893	200	-762,631	200	-89,444	200	-1,165,405
	300	-955,853	300	-655,831	300	-59,540	300	-870,637
	400	-656,813	400	-549,031	400	-29,636	400	-575,869
	500	-357,773	500	-442,231	500	268	500	-281,101
	600	-58,733	600	-335,431	600	30,172	600	13,667
	700	240,307	700	-228,631	700	60,076	700	308,435
	800	539,347	800	-121,831	800	89,980	800	603,203
	900	838,387	900	-15,031	900	119,884	900	897,971
	1,000	1,137,427	1,000	91,769	1,000	149,788	1,000	1,192,739

DBO Pro Forma for Four Communities at New London (ISDR 2000)[48]

[48] Sensitivity analysis performed in the lower portion of the figure shows where rent thresholds exist.

APPENDIX B

San Diego Pro-Forma

Rental Income										
1&2 Bedroom										
	E1	E2	E3	E4	E5	E6	E7	E8	E9	Total
Old units	9	53	193	368	464	340	31	2		1460
New units				20	80	100				200
Max. Rent	$625	$625	$625	$650	$735	$836	$911	$971	$1,093	
Monthly Revenue	$5,625	$33,125	$120,625	$252,200	$399,840	$367,840	$28,241	$1,942	$0	$1,209,438
Average GSF		1141								
Market Rate		$850								
3 Bedroom										
	E1	E2	E3	E4	E5	E6	E7	E8	E9	Total
Old units	4	34	160	164	388	253	82	33	6	1124
New units				50	50	200				300
Max. Rent	$625	$625	$625	$650	$735	$836	$911	$971	$1,093	
Monthly Revenue	$2,500	$21,250	$100,000	$139,100	$321,930	$378,708	$74,702	$32,043	$6,558	$1,076,791
Average GSF		1463								
Market Rate		$1,180								
4 Bedroom										
	E1	E2	E3	E4	E5	E6	E7	E8	E9	Total
Old units				2	40	18	12	2	2	76
New units						88				88
Max. Rent	$625	$625	$625	$650	$735	$836	$911	$971	$1,093	
Monthly Revenue	$0	$0	$0	$1,300	$29,400	$88,616	$10,932	$1,942	$2,186	$134,376
Average GSF		1537								
Market Rate		-								
								Continue... total 50 years		
User Fees Estimation										
Quarter	1	2	3	4	5	6	7	8	9	10
Rental Revenue	7,262	7,262	7,262	7,262	7,262	7,262	7,262	7,262	7,262	7,262
Long Term Revitalization	→			(Starting from Year 11)						
Repairs & Rennovation	1,115	1,115	1,115	1,115	78	78	78	78	90	90
Real Estate Taxes	523	523	523	523	523	523	523	523	523	523
User Fees	5,624	5,624	5,624	5,624	6,661	6,661	6,661	6,661	6,649	6,649

San Diego Rent Stream Pro Forma (Southwest Division 1999, Medved et al 2000, and Megliola 2000)

Control Parameters

Annual Discount Rate of Private Sector (Nominal):	10.00%
Assumed Inflation Rate:	3.00%
=> Annual Discount Rate of Private Sector (Real):	6.80%
=> Quarterly Discount Rate for calculating NPV	1.70%

ALL CASH FLOW IN '000S

Base Case Assuming Aid of $20.9 Million from DON is Absent

Continue...total 50 years

Quarter		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Quarterly Cash Flow		(1,714)	(1,822)	(2,403)	(3,277)	(4,084)	(5,981)	(3,368)	(124)	(417)	(806)	(1,253)	(1,701)	(2,049)	(2,214)	(2,246)
NPV in Real Terms:	($14,154.10)															
IRR(Quarterly - Real):	1.15%															

Case 1: With DON's Aid of $20.9 Million, Assume a Lease Term of 50 Years Beyond Completion of Construction

Continue...total 50 years

Quarter		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Quarterly Cash Flow		0	0	0	0	0	0	0	(151)	(444)	(833)	(1,280)	(1,728)	(2,075)	(2,240)	(2,273)
NPV in Real Terms:	$5,972.93															
IRR(Quarterly - Real):	2.18%															

Use of DON's $20.9 million to fund initial expenses

Case 2: With DON's Aid of $20.9 Million, Assume a Lease Term of 30 Years Beyond Completion of Construction

Continue...total 30 years

Quarter		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Quarterly Cash Flow		0	0	0	0	0	0	0	(151)	(444)	(833)	(1,280)	(1,728)	(2,075)	(2,240)	(2,273)
NPV in Real Terms:	($131.54)															
IRR(Quarterly - Real):	1.68%															

Use of DON's $20.9 million to fund initial expenses

Case 3: With DON's Aid of $20.9 Million, Assume a Lease Term of 35 Years Beyond Completion of Construction

Continue...total 35 years

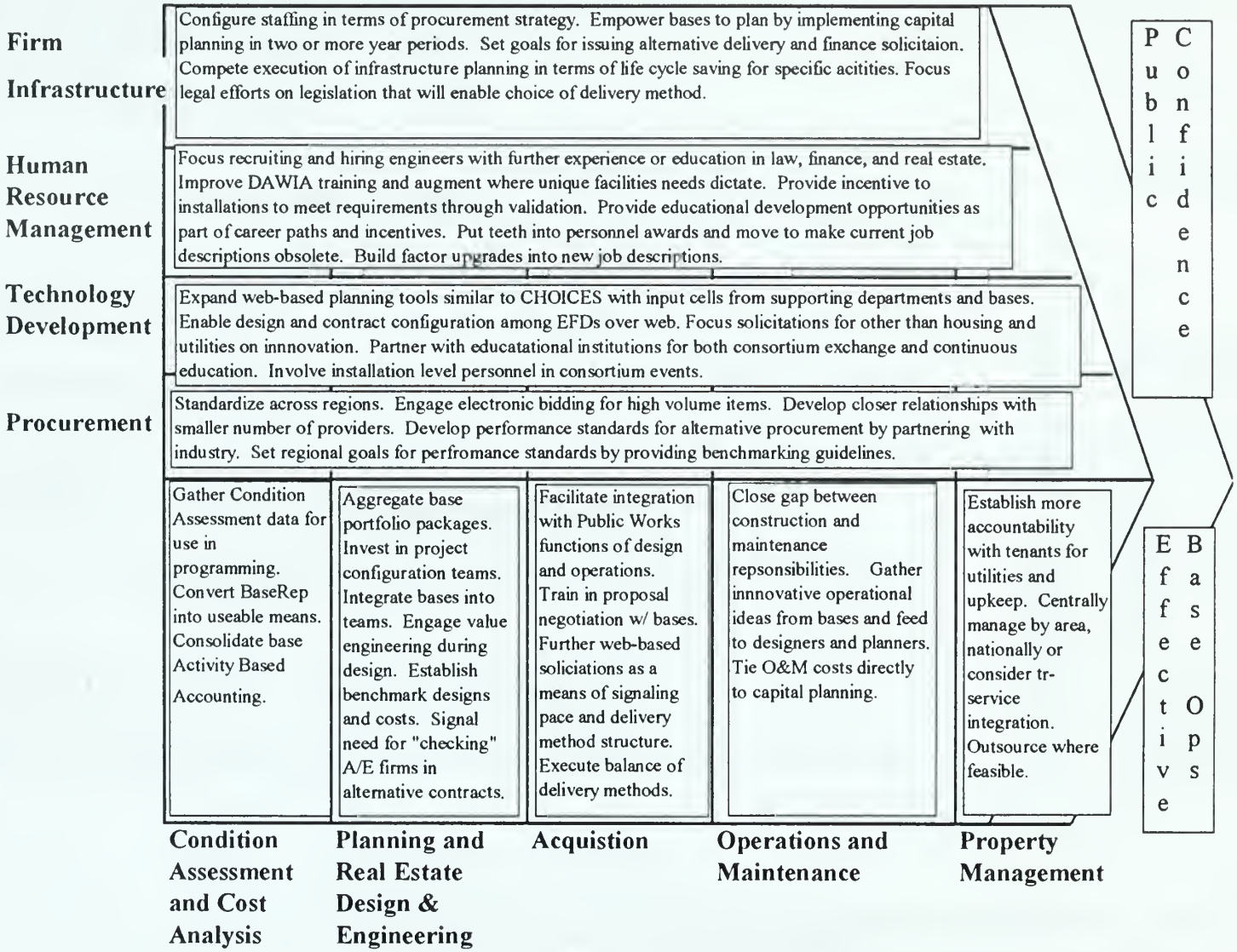
Quarter		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Quarterly Cash Flow		0	0	0	0	0	0	0	(151)	(444)	(833)	(1,280)	(1,728)	(2,075)	(2,240)	(2,273)
NPV in Real Terms:	$2,090.24															
IRR(Quarterly - Real):	1.93%															

Use of DON's $20.9 million to fund initial expenses

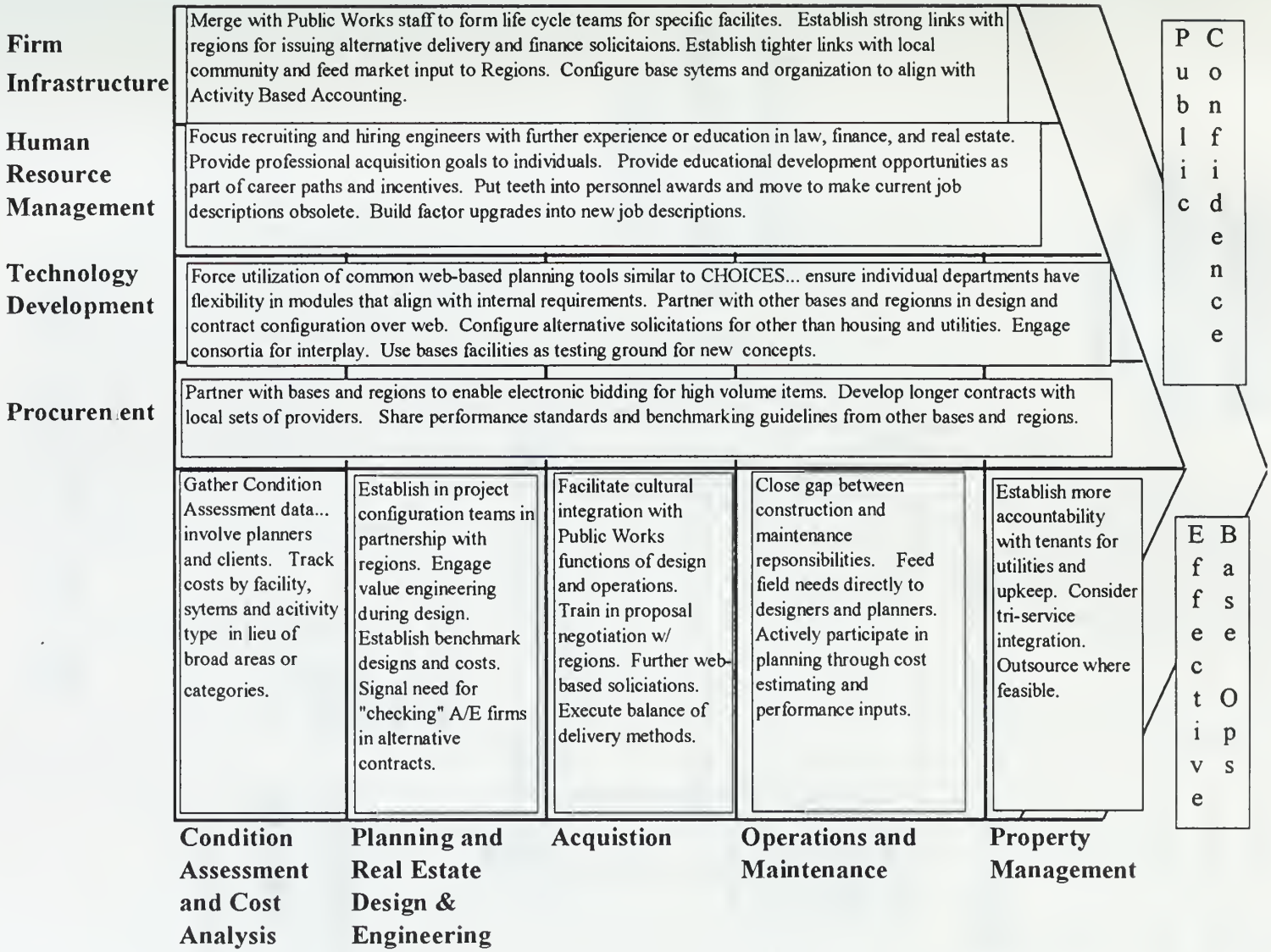
San Diego LLC Net Present Value Calculations (Cheah 2000)

APPENDIX C

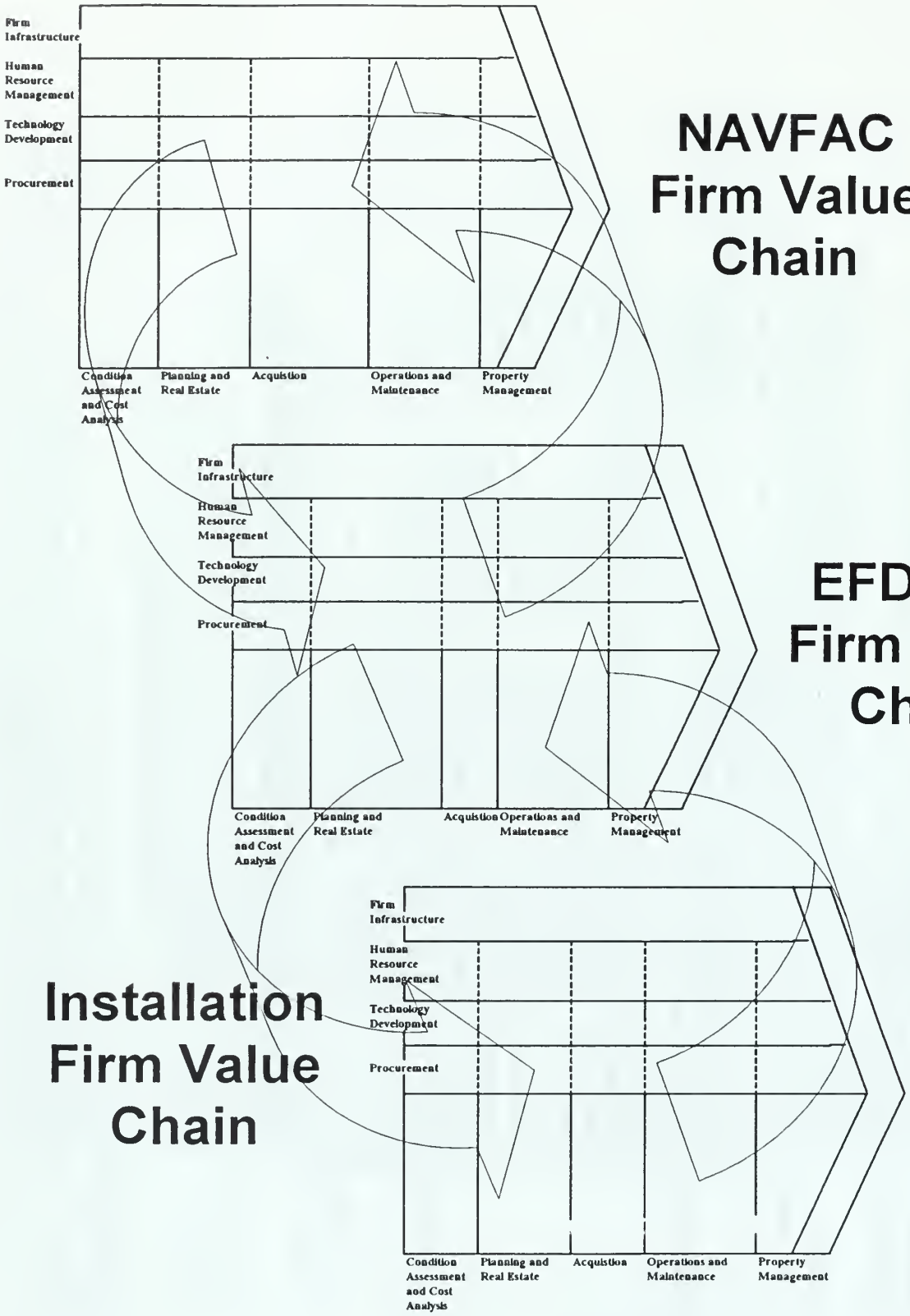
NAVFAC Firm Value Chains


Firm Infrastructure
Configure staffing in terms of procurement strategy. Empower bases to plan by implementing capital planning in two or more year periods. Set goals for issuing alternative delivery and finance solicitaion. Compete execution of infrastructure planning in terms of life cycle saving for specific acitities. Focus legal efforts on legislation that will enable choice of delivery method.
Human Resource Management
Focus recruiting and hiring engineers with further experience or education in law, finance, and real estate. Improve DAWIA training and augment where unique facilities needs dictate. Provide incentive to installations to meet requirements through validation. Provide educational development opportunities as part of career paths and incentives. Put teeth into personnel awards and move to make current job descriptions obsolete. Build factor upgrades into new job descriptions.
Technology Development
Expand web-based planning tools similar to CHOICES with input cells from supporting departments and bases. Enable design and contract configuration among EFDs over web. Focus solicitations for other than housing and utilities on innnovation. Partner with educatational institutions for both consortium exchange and continuous education. Involve installation level personnel in consortium events.
Procurement
Standardize across regions. Engage electronic bidding for high volume items. Develop closer relationships with smaller number of providers. Develop performance standards for alternative procurement by partnering with industry. Set regional goals for perfromance standards by providing benchmarking guidelines.
Public Confidence
Effective Base Ops
Gather Condition Assessment data for use in programming. Convert BaseRep into useable means. Consolidate base Activity Based Accounting.
Aggregate base portfolio packages. Invest in project configuration teams. Integrate bases into teams. Engage value engineering during design. Establish benchmark designs and costs. Signal need for "checking" A/E firms in alternative contracts.
Facilitate integration with Public Works functions of design and operations. Train in proposal negotiation w/ bases. Further web-based soliciations as a means of signaling pace and delivery method structure. Execute balance of delivery methods.
Close gap between construction and maintenance repsonsibilities. Gather innnovative operational ideas from bases and feed to designers and planners. Tie O&M costs directly to capital planning.
Establish more accountability with tenants for utilities and upkeep. Centrally manage by area, nationally or consider tr-service integration. Outsource where feasible.
Condition Assessment and Cost Analysis
Planning and Real Estate Design & Engineering
Acquistion
Operations and Maintenance
Property Management

Engineering Field Division/Activity Firm Value Chain Refinements


Firm Infrastructure
Merge with Public Works staff to form life cycle teams for specific facilites. Establish strong links with regions for issuing alternative delivery and finance solicitaions. Establish tighter links with local community and feed market input to Regions. Configure base sytems and organization to align with Activity Based Accounting.
Human Resource Management
Focus recruiting and hiring engineers with further experience or education in law, finance, and real estate. Provide professional acquisition goals to individuals. Provide educational development opportunities as part of career paths and incentives. Put teeth into personnel awards and move to make current job descriptions obsolete. Build factor upgrades into new job descriptions.
Technology Development
Force utilization of common web-based planning tools similar to CHOICES... ensure individual departments have flexibility in modules that align with internal requirements. Partner with other bases and regionns in design and contract configuration over web. Configure alternative solicitations for other than housing and utilities. Engage consortia for interplay. Use bases facilities as testing ground for new concepts.
Procurement
Partner with bases and regions to enable electronic bidding for high volume items. Develop longer contracts with local sets of providers. Share performance standards and benchmarking guidelines from other bases and regions.
Public Confidence
Gather Condition Assessment data... involve planners and clients. Track costs by facility, sytems and acitivity type in lieu of broad areas or categories.
Establish in project configuration teams in partnership with regions. Engage value engineering during design. Establish benchmark designs and costs. Signal need for "checking" A/E firms in alternative contracts.
Facilitate cultural integration with Public Works functions of design and operations. Train in proposal negotiation w/ regions. Further web-based soliciations. Execute balance of delivery methods.
Close gap between construction and maintenance repsonsibilities. Feed field needs directly to designers and planners. Actively participate in planning through cost estimating and performance inputs.
Establish more accountability with tenants for utilities and upkeep. Consider tri-service integration. Outsource where feasible.
Effective Base Ops
Condition Assessment and Cost Analysis
Planning and Real Estate Design & Engineering
Acquistion
Operations and Maintenance
Property Management

Installation Firm Value Chain Refinements



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